Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

ELECTRONIC SUPPLEMENTARY INFORMATION

Chemometric Approach for the Design of Lanthanum-based High Entropy Perovskite Oxides

Luca Angelo Betti,[a] Lisa Rita Magnaghi,[a,*] Aldo Bosetti,[b] Raffaella Biesuz[a], Lorenzo Malavasi[a,*]

[a]*Department of Chemistry, University of Pavia and INSTM, Viale Taramelli 16, Pavia, Italy.*

[b]*Eni S.p.A., Eni Research Centre, Via Fause 4, Novara, Italy.*

Stability domain estimation

Table S1. Complete list of candidate points (1001) to be submitted to D-Optimal Design for La(Cr,Mn,Fe,Co,M)O_3 systems, whereas M stands for Ni or Zn, and samples included in the reduced candidate point lists for Ni≤0.9 (seventh column, 1000 samples), Ni≤0.8 (eighth column, 996 samples) and Zn≤0.5 (last column, 931 samples).

n	Complete candidate point matrix (cp)					Samples included in reduced cps		
	Cr	**Mn**	**Fe**	**Co**	**M**	**Ni≤0.9**	**Ni≤0.8**	**Zn≤0.5**
1	1	0	0	0	0	✓	✓	✓
2	0.9	0.1	0	0	0	✓	✓	✓
3	0.9	0	0.1	0	0	✓	✓	✓
4	0.9	0	0	0.1	0	✓	✓	✓
5	0.8	0.2	0	0	0	✓	✓	✓
6	0.8	0.1	0.1	0	0	✓	✓	✓
7	0.8	0.1	0	0.1	0	✓	✓	✓
8	0.8	0	0.2	0	0	✓	✓	✓
9	0.8	0	0.1	0.1	0	✓	✓	✓
10	0.8	0	0	0.2	0	✓	✓	✓
11	0.7	0.3	0	0	0	✓	✓	✓
12	0.7	0.2	0.1	0	0	✓	✓	✓
13	0.7	0.2	0	0.1	0	✓	✓	✓
14	0.7	0.1	0.2	0	0	✓	✓	✓
15	0.7	0.1	0.1	0.1	0	✓	✓	✓
16	0.7	0.1	0	0.2	0	✓	✓	✓
17	0.7	0	0.3	0	0	✓	✓	✓
18	0.7	0	0.2	0.1	0	✓	✓	✓
19	0.7	0	0.1	0.2	0	✓	✓	✓
20	0.7	0	0	0.3	0	✓	✓	✓
21	0.6	0.4	0	0	0	✓	✓	✓
22	0.6	0.3	0.1	0	0	✓	✓	✓
23	0.6	0.3	0	0.1	0	✓	✓	✓
24	0.6	0.2	0.2	0	0	✓	✓	✓
25	0.6	0.2	0.1	0.1	0	✓	✓	✓
26	0.6	0.2	0	0.2	0	✓	✓	✓
27	0.6	0.1	0.3	0	0	✓	✓	✓
28	0.6	0.1	0.2	0.1	0	✓	✓	✓
29	0.6	0.1	0.1	0.2	0	✓	✓	✓
30	0.6	0.1	0	0.3	0	✓	✓	✓
31	0.6	0	0.4	0	0	✓	✓	✓
32	0.6	0	0.3	0.1	0	✓	✓	✓
33	0.6	0	0.2	0.2	0	✓	✓	✓
34	0.6	0	0.1	0.3	0	✓	✓	✓
35	0.6	0	0	0.4	0	✓	✓	✓
36	0.5	0.5	0	0	0	✓	✓	✓
37	0.5	0.4	0.1	0	0	✓	✓	✓

38	0.5	0.4	0	0.1	0	✓	✓	✓
39	0.5	0.3	0.2	0	0	✓	✓	✓
40	0.5	0.3	0.1	0.1	0	✓	✓	✓
41	0.5	0.3	0	0.2	0	✓	✓	✓
42	0.5	0.2	0.3	0	0	✓	✓	✓
43	0.5	0.2	0.2	0.1	0	✓	✓	✓
44	0.5	0.2	0.1	0.2	0	✓	✓	✓
45	0.5	0.2	0	0.3	0	✓	✓	✓
46	0.5	0.1	0.4	0	0	✓	✓	✓
47	0.5	0.1	0.3	0.1	0	✓	✓	✓
48	0.5	0.1	0.2	0.2	0	✓	✓	✓
49	0.5	0.1	0.1	0.3	0	✓	✓	✓
50	0.5	0.1	0	0.4	0	✓	✓	✓
51	0.5	0	0.5	0	0	✓	✓	✓
52	0.5	0	0.4	0.1	0	✓	✓	✓
53	0.5	0	0.3	0.2	0	✓	✓	✓
54	0.5	0	0.2	0.3	0	✓	✓	✓
55	0.5	0	0.1	0.4	0	✓	✓	✓
56	0.5	0	0	0.5	0	✓	✓	✓
57	0.4	0.6	0	0	0	✓	✓	✓
58	0.4	0.5	0.1	0	0	✓	✓	✓
59	0.4	0.5	0	0.1	0	✓	✓	✓
60	0.4	0.4	0.2	0	0	✓	✓	✓
61	0.4	0.4	0.1	0.1	0	✓	✓	✓
62	0.4	0.4	0	0.2	0	✓	✓	✓
63	0.4	0.3	0.3	0	0	✓	✓	✓
64	0.4	0.3	0.2	0.1	0	✓	✓	✓
65	0.4	0.3	0.1	0.2	0	✓	✓	✓
66	0.4	0.3	0	0.3	0	✓	✓	✓
67	0.4	0.2	0.4	0	0	✓	✓	✓
68	0.4	0.2	0.2	0.2	0	✓	✓	✓
69	0.4	0.2	0.3	0.1	0	✓	✓	✓
70	0.4	0.1	0.3	0.2	0	✓	✓	✓
71	0.4	0.2	0.1	0.3	0	✓	✓	✓
72	0.4	0.1	0.2	0.3	0	✓	✓	✓
73	0.4	0.2	0	0.4	0	✓	✓	✓
74	0.4	0.1	0.5	0	0	✓	✓	✓
75	0.4	0.1	0.4	0.1	0	✓	✓	✓
76	0.4	0.1	0.1	0.4	0	✓	✓	✓
77	0.4	0.1	0	0.5	0	✓	✓	✓
78	0.4	0	0.6	0	0	✓	✓	✓
79	0.4	0	0.5	0.1	0	✓	✓	✓
80	0.4	0	0.4	0.2	0	✓	✓	✓
81	0.4	0	0.3	0.3	0	✓	✓	✓
82	0.4	0	0.2	0.4	0	✓	✓	✓
83	0.4	0	0.1	0.5	0	✓	✓	✓
84	0.4	0	0	0.6	0	✓	✓	✓

85	0.3	0.7	0	0	0	✓	✓	✓
86	0.3	0.6	0.1	0	0	✓	✓	✓
87	0.3	0.6	0	0.1	0	✓	✓	✓
88	0.3	0.5	0.2	0	0	✓	✓	✓
89	0.3	0.5	0.1	0.1	0	✓	✓	✓
90	0.3	0.5	0	0.2	0	✓	✓	✓
91	0.3	0.4	0.3	0	0	✓	✓	✓
92	0.3	0.4	0.2	0.1	0	✓	✓	✓
93	0.3	0.4	0.1	0.2	0	✓	✓	✓
94	0.3	0.4	0	0.3	0	✓	✓	✓
95	0.3	0.3	0.4	0	0	✓	✓	✓
96	0.3	0.3	0.3	0.1	0	✓	✓	✓
97	0.3	0.3	0.2	0.2	0	✓	✓	✓
98	0.3	0.3	0.1	0.3	0	✓	✓	✓
99	0.3	0.3	0	0.4	0	✓	✓	✓
100	0.3	0.2	0.5	0	0	✓	✓	✓
101	0.3	0.2	0.4	0.1	0	✓	✓	✓
102	0.3	0.2	0.3	0.2	0	✓	✓	✓
103	0.3	0.2	0.2	0.3	0	✓	✓	✓
104	0.3	0.2	0.1	0.4	0	✓	✓	✓
105	0.3	0.2	0	0.5	0	✓	✓	✓
106	0.3	0.1	0.6	0	0	✓	✓	✓
107	0.3	0.1	0.5	0.1	0	✓	✓	✓
108	0.3	0.1	0.4	0.2	0	✓	✓	✓
109	0.3	0.1	0.3	0.3	0	✓	✓	✓
110	0.3	0.1	0.2	0.4	0	✓	✓	✓
111	0.3	0.1	0.1	0.5	0	✓	✓	✓
112	0.3	0.1	0	0.6	0	✓	✓	✓
113	0.3	0	0.7	0	0	✓	✓	✓
114	0.3	0	0.6	0.1	0	✓	✓	✓
115	0.3	0	0.5	0.2	0	✓	✓	✓
116	0.3	0	0.4	0.3	0	✓	✓	✓
117	0.3	0	0.3	0.4	0	✓	✓	✓
118	0.3	0	0.2	0.5	0	✓	✓	✓
119	0.3	0	0.1	0.6	0	✓	✓	✓
120	0.3	0	0	0.7	0	✓	✓	✓
121	0.2	0.8	0	0	0	✓	✓	✓
122	0.2	0.7	0.1	0	0	✓	✓	✓
123	0.2	0.7	0	0.1	0	✓	✓	✓
124	0.2	0.6	0.2	0	0	✓	✓	✓
125	0.2	0.6	0.1	0.1	0	✓	✓	✓
126	0.2	0.6	0	0.2	0	✓	✓	✓
127	0.2	0.5	0.3	0	0	✓	✓	✓
128	0.2	0.5	0.2	0.1	0	✓	✓	✓
129	0.2	0.5	0.1	0.2	0	✓	✓	✓
130	0.2	0.5	0	0.3	0	✓	✓	✓
131	0.2	0.4	0.4	0	0	✓	✓	✓

132	0.2	0.4	0.3	0.1	0	✓	✓	✓
133	0.2	0.4	0.2	0.2	0	✓	✓	✓
134	0.2	0.4	0.1	0.3	0	✓	✓	✓
135	0.2	0.4	0	0.4	0	✓	✓	✓
136	0.2	0.3	0.5	0	0	✓	✓	✓
137	0.2	0.3	0.4	0.1	0	✓	✓	✓
138	0.2	0.3	0.3	0.2	0	✓	✓	✓
139	0.2	0.3	0.2	0.3	0	✓	✓	✓
140	0.2	0.3	0.1	0.4	0	✓	✓	✓
141	0.2	0.3	0	0.5	0	✓	✓	✓
142	0.2	0.2	0.6	0	0	✓	✓	✓
143	0.2	0.2	0.5	0.1	0	✓	✓	✓
144	0.2	0.2	0.4	0.2	0	✓	✓	✓
145	0.2	0.2	0.3	0.3	0	✓	✓	✓
146	0.2	0.2	0.2	0.4	0	✓	✓	✓
147	0.2	0.2	0.1	0.5	0	✓	✓	✓
148	0.2	0.2	0	0.6	0	✓	✓	✓
149	0.2	0.1	0.7	0	0	✓	✓	✓
150	0.2	0.1	0.6	0.1	0	✓	✓	✓
151	0.2	0.1	0.5	0.2	0	✓	✓	✓
152	0.2	0.1	0.4	0.3	0	✓	✓	✓
153	0.2	0.1	0.3	0.4	0	✓	✓	✓
154	0.2	0.1	0.2	0.5	0	✓	✓	✓
155	0.2	0.1	0.1	0.6	0	✓	✓	✓
156	0.2	0.1	0	0.7	0	✓	✓	✓
157	0.2	0	0.8	0	0	✓	✓	✓
158	0.2	0	0.7	0.1	0	✓	✓	✓
159	0.2	0	0.6	0.2	0	✓	✓	✓
160	0.2	0	0.5	0.3	0	✓	✓	✓
161	0.2	0	0.4	0.4	0	✓	✓	✓
162	0.2	0	0.3	0.5	0	✓	✓	✓
163	0.2	0	0.2	0.6	0	✓	✓	✓
164	0.2	0	0.1	0.7	0	✓	✓	✓
165	0.2	0	0	0.8	0	✓	✓	✓
166	0.1	0.9	0	0	0	✓	✓	✓
167	0.1	0.8	0.1	0	0	✓	✓	✓
168	0.1	0.8	0	0.1	0	✓	✓	✓
169	0.1	0.7	0.2	0	0	✓	✓	✓
170	0.1	0.7	0.1	0.1	0	✓	✓	✓
171	0.1	0.7	0	0.2	0	✓	✓	✓
172	0.1	0.6	0.3	0	0	✓	✓	✓
173	0.1	0.6	0.2	0.1	0	✓	✓	✓
174	0.1	0.6	0.1	0.2	0	✓	✓	✓
175	0.1	0.6	0	0.3	0	✓	✓	✓
176	0.1	0.5	0.4	0	0	✓	✓	✓
177	0.1	0.5	0.3	0.1	0	✓	✓	✓
178	0.1	0.5	0.2	0.2	0	✓	✓	✓

179	0.1	0.5	0.1	0.3	0	✓	✓	✓
180	0.1	0.5	0	0.4	0	✓	✓	✓
181	0.1	0.4	0.5	0	0	✓	✓	✓
182	0.1	0.4	0.4	0.1	0	✓	✓	✓
183	0.1	0.4	0.3	0.2	0	✓	✓	✓
184	0.1	0.4	0.2	0.3	0	✓	✓	✓
185	0.1	0.4	0.1	0.4	0	✓	✓	✓
186	0.1	0.4	0	0.5	0	✓	✓	✓
187	0.1	0.3	0.6	0	0	✓	✓	✓
188	0.1	0.3	0.5	0.1	0	✓	✓	✓
189	0.1	0.3	0.4	0.2	0	✓	✓	✓
190	0.1	0.3	0.3	0.3	0	✓	✓	✓
191	0.1	0.3	0.2	0.4	0	✓	✓	✓
192	0.1	0.3	0.1	0.5	0	✓	✓	✓
193	0.1	0.3	0	0.6	0	✓	✓	✓
194	0.1	0.2	0.7	0	0	✓	✓	✓
195	0.1	0.2	0.6	0.1	0	✓	✓	✓
196	0.1	0.2	0.5	0.2	0	✓	✓	✓
197	0.1	0.2	0.4	0.3	0	✓	✓	✓
198	0.1	0.2	0.3	0.4	0	✓	✓	✓
199	0.1	0.2	0.2	0.5	0	✓	✓	✓
200	0.1	0.2	0.1	0.6	0	✓	✓	✓
201	0.1	0.2	0	0.7	0	✓	✓	✓
202	0.1	0.1	0.8	0	0	✓	✓	✓
203	0.1	0.1	0.7	0.1	0	✓	✓	✓
204	0.1	0.1	0.6	0.2	0	✓	✓	✓
205	0.1	0.1	0.5	0.3	0	✓	✓	✓
206	0.1	0.1	0.4	0.4	0	✓	✓	✓
207	0.1	0.1	0.3	0.5	0	✓	✓	✓
208	0.1	0.1	0.2	0.6	0	✓	✓	✓
209	0.1	0.1	0.1	0.7	0	✓	✓	✓
210	0.1	0.1	0	0.8	0	✓	✓	✓
211	0.1	0	0.9	0	0	✓	✓	✓
212	0.1	0	0.8	0.1	0	✓	✓	✓
213	0.1	0	0.7	0.2	0	✓	✓	✓
214	0.1	0	0.6	0.3	0	✓	✓	✓
215	0.1	0	0.5	0.4	0	✓	✓	✓
216	0.1	0	0.4	0.5	0	✓	✓	✓
217	0.1	0	0.3	0.6	0	✓	✓	✓
218	0.1	0	0.2	0.7	0	✓	✓	✓
219	0.1	0	0.1	0.8	0	✓	✓	✓
220	0.1	0	0	0.9	0	✓	✓	✓
221	0	1	0	0	0	✓	✓	✓
222	0	0.9	0.1	0	0	✓	✓	✓
223	0	0.9	0	0.1	0	✓	✓	✓
224	0	0.8	0.2	0	0	✓	✓	✓
225	0	0.8	0.1	0.1	0	✓	✓	✓

226	0	0.8	0	0.2	0	✓	✓	✓
227	0	0.7	0.3	0	0	✓	✓	✓
228	0	0.7	0.2	0.1	0	✓	✓	✓
229	0	0.7	0.1	0.2	0	✓	✓	✓
230	0	0.7	0	0.3	0	✓	✓	✓
231	0	0.6	0.4	0	0	✓	✓	✓
232	0	0.6	0.3	0.1	0	✓	✓	✓
233	0	0.6	0.2	0.2	0	✓	✓	✓
234	0	0.6	0.1	0.3	0	✓	✓	✓
235	0	0.6	0	0.4	0	✓	✓	✓
236	0	0.5	0.5	0	0	✓	✓	✓
237	0	0.5	0.4	0.1	0	✓	✓	✓
238	0	0.5	0.3	0.2	0	✓	✓	✓
239	0	0.5	0.2	0.3	0	✓	✓	✓
240	0	0.5	0.1	0.4	0	✓	✓	✓
241	0	0.5	0	0.5	0	✓	✓	✓
242	0	0.4	0.6	0	0	✓	✓	✓
243	0	0.4	0.5	0.1	0	✓	✓	✓
244	0	0.4	0.4	0.2	0	✓	✓	✓
245	0	0.4	0.3	0.3	0	✓	✓	✓
246	0	0.4	0.2	0.4	0	✓	✓	✓
247	0	0.4	0.1	0.5	0	✓	✓	✓
248	0	0.4	0	0.6	0	✓	✓	✓
249	0	0.3	0.7	0	0	✓	✓	✓
250	0	0.3	0.6	0.1	0	✓	✓	✓
251	0	0.3	0.5	0.2	0	✓	✓	✓
252	0	0.3	0.4	0.3	0	✓	✓	✓
253	0	0.3	0.3	0.4	0	✓	✓	✓
254	0	0.3	0.2	0.5	0	✓	✓	✓
255	0	0.3	0.1	0.6	0	✓	✓	✓
256	0	0.3	0	0.7	0	✓	✓	✓
257	0	0.2	0.8	0	0	✓	✓	✓
258	0	0.2	0.7	0.1	0	✓	✓	✓
259	0	0.2	0.6	0.2	0	✓	✓	✓
260	0	0.2	0.5	0.3	0	✓	✓	✓
261	0	0.2	0.4	0.4	0	✓	✓	✓
262	0	0.2	0.3	0.5	0	✓	✓	✓
263	0	0.2	0.2	0.6	0	✓	✓	✓
264	0	0.2	0.1	0.7	0	✓	✓	✓
265	0	0.2	0	0.8	0	✓	✓	✓
266	0	0.1	0.9	0	0	✓	✓	✓
267	0	0.1	0.8	0.1	0	✓	✓	✓
268	0	0.1	0.7	0.2	0	✓	✓	✓
269	0	0.1	0.6	0.3	0	✓	✓	✓
270	0	0.1	0.5	0.4	0	✓	✓	✓
271	0	0.1	0.4	0.5	0	✓	✓	✓
272	0	0.1	0.3	0.6	0	✓	✓	✓

273	0	0.1	0.2	0.7	0	✓	✓	✓
274	0	0.1	0.1	0.8	0	✓	✓	✓
275	0	0.1	0	0.9	0	✓	✓	✓
276	0	0	1	0	0	✓	✓	✓
277	0	0	0.9	0.1	0	✓	✓	✓
278	0	0	0.8	0.2	0	✓	✓	✓
279	0	0	0.7	0.3	0	✓	✓	✓
280	0	0	0.6	0.4	0	✓	✓	✓
281	0	0	0.5	0.5	0	✓	✓	✓
282	0	0	0.4	0.6	0	✓	✓	✓
283	0	0	0.3	0.7	0	✓	✓	✓
284	0	0	0.2	0.8	0	✓	✓	✓
285	0	0	0.1	0.9	0	✓	✓	✓
286	0	0	0	1	0	✓	✓	✓
287	0.9	0	0	0	0.1	✓	✓	✓
288	0.8	0.1	0	0	0.1	✓	✓	✓
289	0.8	0	0.1	0	0.1	✓	✓	✓
290	0.8	0	0	0.1	0.1	✓	✓	✓
291	0.7	0.2	0	0	0.1	✓	✓	✓
292	0.7	0.1	0.1	0	0.1	✓	✓	✓
293	0.7	0.1	0	0.1	0.1	✓	✓	✓
294	0.7	0	0.2	0	0.1	✓	✓	✓
295	0.7	0	0.1	0.1	0.1	✓	✓	✓
296	0.7	0	0	0.2	0.1	✓	✓	✓
297	0.6	0.3	0	0	0.1	✓	✓	✓
298	0.6	0.2	0.1	0	0.1	✓	✓	✓
299	0.6	0.2	0	0.1	0.1	✓	✓	✓
300	0.6	0.1	0.2	0	0.1	✓	✓	✓
301	0.6	0.1	0.1	0.1	0.1	✓	✓	✓
302	0.6	0.1	0	0.2	0.1	✓	✓	✓
303	0.6	0	0.3	0	0.1	✓	✓	✓
304	0.6	0	0.2	0.1	0.1	✓	✓	✓
305	0.6	0	0.1	0.2	0.1	✓	✓	✓
306	0.6	0	0	0.3	0.1	✓	✓	✓
307	0.5	0.4	0	0	0.1	✓	✓	✓
308	0.5	0.3	0.1	0	0.1	✓	✓	✓
309	0.5	0.3	0	0.1	0.1	✓	✓	✓
310	0.5	0.2	0.2	0	0.1	✓	✓	✓
311	0.5	0.2	0.1	0.1	0.1	✓	✓	✓
312	0.5	0.2	0	0.2	0.1	✓	✓	✓
313	0.5	0.1	0.3	0	0.1	✓	✓	✓
314	0.5	0.1	0.2	0.1	0.1	✓	✓	✓
315	0.5	0.1	0.1	0.2	0.1	✓	✓	✓
316	0.5	0.1	0	0.3	0.1	✓	✓	✓
317	0.5	0	0.4	0	0.1	✓	✓	✓
318	0.5	0	0.3	0.1	0.1	✓	✓	✓
319	0.5	0	0.2	0.2	0.1	✓	✓	✓

320	0.5	0	0.1	0.3	0.1	✓	✓	✓
321	0.5	0	0	0.4	0.1	✓	✓	✓
322	0.4	0.5	0	0	0.1	✓	✓	✓
323	0.4	0.4	0.1	0	0.1	✓	✓	✓
324	0.4	0.4	0	0.1	0.1	✓	✓	✓
325	0.4	0.3	0.2	0	0.1	✓	✓	✓
326	0.4	0.3	0.1	0.1	0.1	✓	✓	✓
327	0.4	0.3	0	0.2	0.1	✓	✓	✓
328	0.4	0.2	0.2	0.1	0.1	✓	✓	✓
329	0.4	0.2	0.3	0	0.1	✓	✓	✓
330	0.4	0	0.3	0.2	0.1	✓	✓	✓
331	0.4	0.2	0	0.3	0.1	✓	✓	✓
332	0.4	0	0.2	0.3	0.1	✓	✓	✓
333	0.4	0.2	0.1	0.2	0.1	✓	✓	✓
334	0.4	0.1	0.4	0	0.1	✓	✓	✓
335	0.4	0.1	0.3	0.1	0.1	✓	✓	✓
336	0.4	0.1	0.2	0.2	0.1	✓	✓	✓
337	0.4	0.1	0.1	0.3	0.1	✓	✓	✓
338	0.4	0.1	0	0.4	0.1	✓	✓	✓
339	0.4	0	0.5	0	0.1	✓	✓	✓
340	0.4	0	0.4	0.1	0.1	✓	✓	✓
341	0.4	0	0.1	0.4	0.1	✓	✓	✓
342	0.4	0	0	0.5	0.1	✓	✓	✓
343	0.3	0.6	0	0	0.1	✓	✓	✓
344	0.3	0.5	0.1	0	0.1	✓	✓	✓
345	0.3	0.5	0	0.1	0.1	✓	✓	✓
346	0.3	0.4	0.2	0	0.1	✓	✓	✓
347	0.3	0.4	0.1	0.1	0.1	✓	✓	✓
348	0.3	0.4	0	0.2	0.1	✓	✓	✓
349	0.3	0.3	0.3	0	0.1	✓	✓	✓
350	0.3	0.3	0.2	0.1	0.1	✓	✓	✓
351	0.3	0.3	0.1	0.2	0.1	✓	✓	✓
352	0.3	0.3	0	0.3	0.1	✓	✓	✓
353	0.3	0.2	0.4	0	0.1	✓	✓	✓
354	0.3	0.2	0.3	0.1	0.1	✓	✓	✓
355	0.3	0.2	0.2	0.2	0.1	✓	✓	✓
356	0.3	0.2	0.1	0.3	0.1	✓	✓	✓
357	0.3	0.2	0	0.4	0.1	✓	✓	✓
358	0.3	0.1	0.5	0	0.1	✓	✓	✓
359	0.3	0.1	0.4	0.1	0.1	✓	✓	✓
360	0.3	0.1	0.3	0.2	0.1	✓	✓	✓
361	0.3	0.1	0.2	0.3	0.1	✓	✓	✓
362	0.3	0.1	0.1	0.4	0.1	✓	✓	✓
363	0.3	0.1	0	0.5	0.1	✓	✓	✓
364	0.3	0	0.6	0	0.1	✓	✓	✓
365	0.3	0	0.5	0.1	0.1	✓	✓	✓
366	0.3	0	0.4	0.2	0.1	✓	✓	✓

367	0.3	0	0.3	0.3	0.1	✓	✓	✓
368	0.3	0	0.2	0.4	0.1	✓	✓	✓
369	0.3	0	0.1	0.5	0.1	✓	✓	✓
370	0.3	0	0	0.6	0.1	✓	✓	✓
371	0.2	0.7	0	0	0.1	✓	✓	✓
372	0.2	0.6	0.1	0	0.1	✓	✓	✓
373	0.2	0.6	0	0.1	0.1	✓	✓	✓
374	0.2	0.5	0.2	0	0.1	✓	✓	✓
375	0.2	0.5	0.1	0.1	0.1	✓	✓	✓
376	0.2	0.5	0	0.2	0.1	✓	✓	✓
377	0.2	0.4	0.3	0	0.1	✓	✓	✓
378	0.2	0.4	0.2	0.1	0.1	✓	✓	✓
379	0.2	0.4	0.1	0.2	0.1	✓	✓	✓
380	0.2	0.4	0	0.3	0.1	✓	✓	✓
381	0.2	0.3	0.4	0	0.1	✓	✓	✓
382	0.2	0.3	0.3	0.1	0.1	✓	✓	✓
383	0.2	0.3	0.2	0.2	0.1	✓	✓	✓
384	0.2	0.3	0.1	0.3	0.1	✓	✓	✓
385	0.2	0.3	0	0.4	0.1	✓	✓	✓
386	0.2	0.2	0.5	0	0.1	✓	✓	✓
387	0.2	0.2	0.4	0.1	0.1	✓	✓	✓
388	0.2	0.2	0.3	0.2	0.1	✓	✓	✓
389	0.2	0.2	0.2	0.3	0.1	✓	✓	✓
390	0.2	0.2	0.1	0.4	0.1	✓	✓	✓
391	0.2	0.2	0	0.5	0.1	✓	✓	✓
392	0.2	0.1	0.6	0	0.1	✓	✓	✓
393	0.2	0.1	0.5	0.1	0.1	✓	✓	✓
394	0.2	0.1	0.4	0.2	0.1	✓	✓	✓
395	0.2	0.1	0.3	0.3	0.1	✓	✓	✓
396	0.2	0.1	0.2	0.4	0.1	✓	✓	✓
397	0.2	0.1	0.1	0.5	0.1	✓	✓	✓
398	0.2	0.1	0	0.6	0.1	✓	✓	✓
399	0.2	0	0.7	0	0.1	✓	✓	✓
400	0.2	0	0.6	0.1	0.1	✓	✓	✓
401	0.2	0	0.5	0.2	0.1	✓	✓	✓
402	0.2	0	0.4	0.3	0.1	✓	✓	✓
403	0.2	0	0.3	0.4	0.1	✓	✓	✓
404	0.2	0	0.2	0.5	0.1	✓	✓	✓
405	0.2	0	0.1	0.6	0.1	✓	✓	✓
406	0.2	0	0	0.7	0.1	✓	✓	✓
407	0.1	0.8	0	0	0.1	✓	✓	✓
408	0.1	0.7	0.1	0	0.1	✓	✓	✓
409	0.1	0.7	0	0.1	0.1	✓	✓	✓
410	0.1	0.6	0.2	0	0.1	✓	✓	✓
411	0.1	0.6	0.1	0.1	0.1	✓	✓	✓
412	0.1	0.6	0	0.2	0.1	✓	✓	✓
413	0.1	0.5	0.3	0	0.1	✓	✓	✓

414	0.1	0.5	0.2	0.1	0.1	✓	✓	✓
415	0.1	0.5	0.1	0.2	0.1	✓	✓	✓
416	0.1	0.5	0	0.3	0.1	✓	✓	✓
417	0.1	0.4	0.4	0	0.1	✓	✓	✓
418	0.1	0.4	0.3	0.1	0.1	✓	✓	✓
419	0.1	0.4	0.2	0.2	0.1	✓	✓	✓
420	0.1	0.4	0.1	0.3	0.1	✓	✓	✓
421	0.1	0.4	0	0.4	0.1	✓	✓	✓
422	0.1	0.3	0.5	0	0.1	✓	✓	✓
423	0.1	0.3	0.4	0.1	0.1	✓	✓	✓
424	0.1	0.3	0.3	0.2	0.1	✓	✓	✓
425	0.1	0.3	0.2	0.3	0.1	✓	✓	✓
426	0.1	0.3	0.1	0.4	0.1	✓	✓	✓
427	0.1	0.3	0	0.5	0.1	✓	✓	✓
428	0.1	0.2	0.6	0	0.1	✓	✓	✓
429	0.1	0.2	0.5	0.1	0.1	✓	✓	✓
430	0.1	0.2	0.4	0.2	0.1	✓	✓	✓
431	0.1	0.2	0.3	0.3	0.1	✓	✓	✓
432	0.1	0.2	0.2	0.4	0.1	✓	✓	✓
433	0.1	0.2	0.1	0.5	0.1	✓	✓	✓
434	0.1	0.2	0	0.6	0.1	✓	✓	✓
435	0.1	0.1	0.7	0	0.1	✓	✓	✓
436	0.1	0.1	0.6	0.1	0.1	✓	✓	✓
437	0.1	0.1	0.5	0.2	0.1	✓	✓	✓
438	0.1	0.1	0.4	0.3	0.1	✓	✓	✓
439	0.1	0.1	0.3	0.4	0.1	✓	✓	✓
440	0.1	0.1	0.2	0.5	0.1	✓	✓	✓
441	0.1	0.1	0.1	0.6	0.1	✓	✓	✓
442	0.1	0.1	0	0.7	0.1	✓	✓	✓
443	0.1	0	0.8	0	0.1	✓	✓	✓
444	0.1	0	0.7	0.1	0.1	✓	✓	✓
445	0.1	0	0.6	0.2	0.1	✓	✓	✓
446	0.1	0	0.5	0.3	0.1	✓	✓	✓
447	0.1	0	0.4	0.4	0.1	✓	✓	✓
448	0.1	0	0.3	0.5	0.1	✓	✓	✓
449	0.1	0	0.2	0.6	0.1	✓	✓	✓
450	0.1	0	0.1	0.7	0.1	✓	✓	✓
451	0.1	0	0	0.8	0.1	✓	✓	✓
452	0	0.9	0	0	0.1	✓	✓	✓
453	0	0.8	0.1	0	0.1	✓	✓	✓
454	0	0.8	0	0.1	0.1	✓	✓	✓
455	0	0.7	0.2	0	0.1	✓	✓	✓
456	0	0.7	0.1	0.1	0.1	✓	✓	✓
457	0	0.7	0	0.2	0.1	✓	✓	✓
458	0	0.6	0.3	0	0.1	✓	✓	✓
459	0	0.6	0.2	0.1	0.1	✓	✓	✓
460	0	0.6	0.1	0.2	0.1	✓	✓	✓

461	0	0.6	0	0.3	0.1	✓	✓	✓
462	0	0.5	0.4	0	0.1	✓	✓	✓
463	0	0.5	0.3	0.1	0.1	✓	✓	✓
464	0	0.5	0.2	0.2	0.1	✓	✓	✓
465	0	0.5	0.1	0.3	0.1	✓	✓	✓
466	0	0.5	0	0.4	0.1	✓	✓	✓
467	0	0.4	0.5	0	0.1	✓	✓	✓
468	0	0.4	0.4	0.1	0.1	✓	✓	✓
469	0	0.4	0.3	0.2	0.1	✓	✓	✓
470	0	0.4	0.2	0.3	0.1	✓	✓	✓
471	0	0.4	0.1	0.4	0.1	✓	✓	✓
472	0	0.4	0	0.5	0.1	✓	✓	✓
473	0	0.3	0.6	0	0.1	✓	✓	✓
474	0	0.3	0.5	0.1	0.1	✓	✓	✓
475	0	0.3	0.4	0.2	0.1	✓	✓	✓
476	0	0.3	0.3	0.3	0.1	✓	✓	✓
477	0	0.3	0.2	0.4	0.1	✓	✓	✓
478	0	0.3	0.1	0.5	0.1	✓	✓	✓
479	0	0.3	0	0.6	0.1	✓	✓	✓
480	0	0.2	0.7	0	0.1	✓	✓	✓
481	0	0.2	0.6	0.1	0.1	✓	✓	✓
482	0	0.2	0.5	0.2	0.1	✓	✓	✓
483	0	0.2	0.4	0.3	0.1	✓	✓	✓
484	0	0.2	0.3	0.4	0.1	✓	✓	✓
485	0	0.2	0.2	0.5	0.1	✓	✓	✓
486	0	0.2	0.1	0.6	0.1	✓	✓	✓
487	0	0.2	0	0.7	0.1	✓	✓	✓
488	0	0.1	0.8	0	0.1	✓	✓	✓
489	0	0.1	0.7	0.1	0.1	✓	✓	✓
490	0	0.1	0.6	0.2	0.1	✓	✓	✓
491	0	0.1	0.5	0.3	0.1	✓	✓	✓
492	0	0.1	0.4	0.4	0.1	✓	✓	✓
493	0	0.1	0.3	0.5	0.1	✓	✓	✓
494	0	0.1	0.2	0.6	0.1	✓	✓	✓
495	0	0.1	0.1	0.7	0.1	✓	✓	✓
496	0	0.1	0	0.8	0.1	✓	✓	✓
497	0	0	0.9	0	0.1	✓	✓	✓
498	0	0	0.8	0.1	0.1	✓	✓	✓
499	0	0	0.7	0.2	0.1	✓	✓	✓
500	0	0	0.6	0.3	0.1	✓	✓	✓
501	0	0	0.5	0.4	0.1	✓	✓	✓
502	0	0	0.4	0.5	0.1	✓	✓	✓
503	0	0	0.3	0.6	0.1	✓	✓	✓
504	0	0	0.2	0.7	0.1	✓	✓	✓
505	0	0	0.1	0.8	0.1	✓	✓	✓
506	0	0	0	0.9	0.1	✓	✓	✓
507	0.8	0	0	0	0.2	✓	✓	✓

508	0.7	0.1	0	0	0.2	✓	✓	✓
509	0.7	0	0.1	0	0.2	✓	✓	✓
510	0.7	0	0	0.1	0.2	✓	✓	✓
511	0.6	0.2	0	0	0.2	✓	✓	✓
512	0.6	0.1	0.1	0	0.2	✓	✓	✓
513	0.6	0.1	0	0.1	0.2	✓	✓	✓
514	0.6	0	0.2	0	0.2	✓	✓	✓
515	0.6	0	0.1	0.1	0.2	✓	✓	✓
516	0.6	0	0	0.2	0.2	✓	✓	✓
517	0.5	0.3	0	0	0.2	✓	✓	✓
518	0.5	0.2	0.1	0	0.2	✓	✓	✓
519	0.5	0.2	0	0.1	0.2	✓	✓	✓
520	0.5	0.1	0.2	0	0.2	✓	✓	✓
521	0.5	0.1	0.1	0.1	0.2	✓	✓	✓
522	0.5	0.1	0	0.2	0.2	✓	✓	✓
523	0.5	0	0.3	0	0.2	✓	✓	✓
524	0.5	0	0.2	0.1	0.2	✓	✓	✓
525	0.5	0	0.1	0.2	0.2	✓	✓	✓
526	0.5	0	0	0.3	0.2	✓	✓	✓
527	0.4	0.4	0	0	0.2	✓	✓	✓
528	0.4	0.3	0.1	0	0.2	✓	✓	✓
529	0.4	0.3	0	0.1	0.2	✓	✓	✓
530	0.4	0.1	0.3	0	0.2	✓	✓	✓
531	0.4	0	0.3	0.1	0.2	✓	✓	✓
532	0.4	0.1	0	0.3	0.2	✓	✓	✓
533	0.4	0	0.1	0.3	0.2	✓	✓	✓
534	0.4	0.2	0.2	0	0.2	✓	✓	✓
535	0.4	0.2	0.1	0.1	0.2	✓	✓	✓
536	0.4	0.2	0	0.2	0.2	✓	✓	✓
537	0.4	0.1	0.2	0.1	0.2	✓	✓	✓
538	0.4	0.1	0.1	0.2	0.2	✓	✓	✓
539	0.4	0	0.4	0	0.2	✓	✓	✓
540	0.4	0	0.2	0.2	0.2	✓	✓	✓
541	0.4	0	0	0.4	0.2	✓	✓	✓
542	0.3	0.5	0	0	0.2	✓	✓	✓
543	0.3	0.4	0.1	0	0.2	✓	✓	✓
544	0.3	0.4	0	0.1	0.2	✓	✓	✓
545	0.3	0.3	0.2	0	0.2	✓	✓	✓
546	0.3	0.3	0.1	0.1	0.2	✓	✓	✓
547	0.3	0.3	0	0.2	0.2	✓	✓	✓
548	0.3	0.2	0.3	0	0.2	✓	✓	✓
549	0.3	0.2	0.2	0.1	0.2	✓	✓	✓
550	0.3	0.2	0.1	0.2	0.2	✓	✓	✓
551	0.3	0.2	0	0.3	0.2	✓	✓	✓
552	0.3	0.1	0.4	0	0.2	✓	✓	✓
553	0.3	0.1	0.3	0.1	0.2	✓	✓	✓
554	0.3	0.1	0.2	0.2	0.2	✓	✓	✓

555	0.3	0.1	0.1	0.3	0.2	✓	✓	✓
556	0.3	0.1	0	0.4	0.2	✓	✓	✓
557	0.3	0	0.5	0	0.2	✓	✓	✓
558	0.3	0	0.4	0.1	0.2	✓	✓	✓
559	0.3	0	0.3	0.2	0.2	✓	✓	✓
560	0.3	0	0.2	0.3	0.2	✓	✓	✓
561	0.3	0	0.1	0.4	0.2	✓	✓	✓
562	0.3	0	0	0.5	0.2	✓	✓	✓
563	0.2	0.6	0	0	0.2	✓	✓	✓
564	0.2	0.5	0.1	0	0.2	✓	✓	✓
565	0.2	0.5	0	0.1	0.2	✓	✓	✓
566	0.2	0.4	0.2	0	0.2	✓	✓	✓
567	0.2	0.4	0.1	0.1	0.2	✓	✓	✓
568	0.2	0.4	0	0.2	0.2	✓	✓	✓
569	0.2	0.3	0.3	0	0.2	✓	✓	✓
570	0.2	0.3	0.2	0.1	0.2	✓	✓	✓
571	0.2	0.3	0.1	0.2	0.2	✓	✓	✓
572	0.2	0.3	0	0.3	0.2	✓	✓	✓
573	0.2	0.2	0.4	0	0.2	✓	✓	✓
574	0.2	0.2	0.3	0.1	0.2	✓	✓	✓
575	0.2	0.2	0.2	0.2	0.2	✓	✓	✓
576	0.2	0.2	0.1	0.3	0.2	✓	✓	✓
577	0.2	0.2	0	0.4	0.2	✓	✓	✓
578	0.2	0.1	0.5	0	0.2	✓	✓	✓
579	0.2	0.1	0.4	0.1	0.2	✓	✓	✓
580	0.2	0.1	0.3	0.2	0.2	✓	✓	✓
581	0.2	0.1	0.2	0.3	0.2	✓	✓	✓
582	0.2	0.1	0.1	0.4	0.2	✓	✓	✓
583	0.2	0.1	0	0.5	0.2	✓	✓	✓
584	0.2	0	0.6	0	0.2	✓	✓	✓
585	0.2	0	0.5	0.1	0.2	✓	✓	✓
586	0.2	0	0.4	0.2	0.2	✓	✓	✓
587	0.2	0	0.3	0.3	0.2	✓	✓	✓
588	0.2	0	0.2	0.4	0.2	✓	✓	✓
589	0.2	0	0.1	0.5	0.2	✓	✓	✓
590	0.2	0	0	0.6	0.2	✓	✓	✓
591	0.1	0.7	0	0	0.2	✓	✓	✓
592	0.1	0.6	0.1	0	0.2	✓	✓	✓
593	0.1	0.6	0	0.1	0.2	✓	✓	✓
594	0.1	0.5	0.2	0	0.2	✓	✓	✓
595	0.1	0.5	0.1	0.1	0.2	✓	✓	✓
596	0.1	0.5	0	0.2	0.2	✓	✓	✓
597	0.1	0.4	0.3	0	0.2	✓	✓	✓
598	0.1	0.4	0.2	0.1	0.2	✓	✓	✓
599	0.1	0.4	0.1	0.2	0.2	✓	✓	✓
600	0.1	0.4	0	0.3	0.2	✓	✓	✓
601	0.1	0.3	0.4	0	0.2	✓	✓	✓

602	0.1	0.3	0.3	0.1	0.2	✓	✓	✓
603	0.1	0.3	0.2	0.2	0.2	✓	✓	✓
604	0.1	0.3	0.1	0.3	0.2	✓	✓	✓
605	0.1	0.3	0	0.4	0.2	✓	✓	✓
606	0.1	0.2	0.5	0	0.2	✓	✓	✓
607	0.1	0.2	0.4	0.1	0.2	✓	✓	✓
608	0.1	0.2	0.3	0.2	0.2	✓	✓	✓
609	0.1	0.2	0.2	0.3	0.2	✓	✓	✓
610	0.1	0.2	0.1	0.4	0.2	✓	✓	✓
611	0.1	0.2	0	0.5	0.2	✓	✓	✓
612	0.1	0.1	0.6	0	0.2	✓	✓	✓
613	0.1	0.1	0.5	0.1	0.2	✓	✓	✓
614	0.1	0.1	0.4	0.2	0.2	✓	✓	✓
615	0.1	0.1	0.3	0.3	0.2	✓	✓	✓
616	0.1	0.1	0.2	0.4	0.2	✓	✓	✓
617	0.1	0.1	0.1	0.5	0.2	✓	✓	✓
618	0.1	0.1	0	0.6	0.2	✓	✓	✓
619	0.1	0	0.7	0	0.2	✓	✓	✓
620	0.1	0	0.6	0.1	0.2	✓	✓	✓
621	0.1	0	0.5	0.2	0.2	✓	✓	✓
622	0.1	0	0.4	0.3	0.2	✓	✓	✓
623	0.1	0	0.3	0.4	0.2	✓	✓	✓
624	0.1	0	0.2	0.5	0.2	✓	✓	✓
625	0.1	0	0.1	0.6	0.2	✓	✓	✓
626	0.1	0	0	0.7	0.2	✓	✓	✓
627	0	0.8	0	0	0.2	✓	✓	✓
628	0	0.7	0.1	0	0.2	✓	✓	✓
629	0	0.7	0	0.1	0.2	✓	✓	✓
630	0	0.6	0.2	0	0.2	✓	✓	✓
631	0	0.6	0.1	0.1	0.2	✓	✓	✓
632	0	0.6	0	0.2	0.2	✓	✓	✓
633	0	0.5	0.3	0	0.2	✓	✓	✓
634	0	0.5	0.2	0.1	0.2	✓	✓	✓
635	0	0.5	0.1	0.2	0.2	✓	✓	✓
636	0	0.5	0	0.3	0.2	✓	✓	✓
637	0	0.4	0.4	0	0.2	✓	✓	✓
638	0	0.4	0.3	0.1	0.2	✓	✓	✓
639	0	0.4	0.2	0.2	0.2	✓	✓	✓
640	0	0.4	0.1	0.3	0.2	✓	✓	✓
641	0	0.4	0	0.4	0.2	✓	✓	✓
642	0	0.3	0.5	0	0.2	✓	✓	✓
643	0	0.3	0.4	0.1	0.2	✓	✓	✓
644	0	0.3	0.3	0.2	0.2	✓	✓	✓
645	0	0.3	0.2	0.3	0.2	✓	✓	✓
646	0	0.3	0.1	0.4	0.2	✓	✓	✓
647	0	0.3	0	0.5	0.2	✓	✓	✓
648	0	0.2	0.6	0	0.2	✓	✓	✓

649	0	0.2	0.5	0.1	0.2	✓	✓	✓
650	0	0.2	0.4	0.2	0.2	✓	✓	✓
651	0	0.2	0.3	0.3	0.2	✓	✓	✓
652	0	0.2	0.2	0.4	0.2	✓	✓	✓
653	0	0.2	0.1	0.5	0.2	✓	✓	✓
654	0	0.2	0	0.6	0.2	✓	✓	✓
655	0	0.1	0.7	0	0.2	✓	✓	✓
656	0	0.1	0.6	0.1	0.2	✓	✓	✓
657	0	0.1	0.5	0.2	0.2	✓	✓	✓
658	0	0.1	0.4	0.3	0.2	✓	✓	✓
659	0	0.1	0.3	0.4	0.2	✓	✓	✓
660	0	0.1	0.2	0.5	0.2	✓	✓	✓
661	0	0.1	0.1	0.6	0.2	✓	✓	✓
662	0	0.1	0	0.7	0.2	✓	✓	✓
663	0	0	0.8	0	0.2	✓	✓	✓
664	0	0	0.7	0.1	0.2	✓	✓	✓
665	0	0	0.6	0.2	0.2	✓	✓	✓
666	0	0	0.5	0.3	0.2	✓	✓	✓
667	0	0	0.4	0.4	0.2	✓	✓	✓
668	0	0	0.3	0.5	0.2	✓	✓	✓
669	0	0	0.2	0.6	0.2	✓	✓	✓
670	0	0	0.1	0.7	0.2	✓	✓	✓
671	0	0	0	0.8	0.2	✓	✓	✓
672	0.7	0	0	0	0.3	✓	✓	✓
673	0.6	0.1	0	0	0.3	✓	✓	✓
674	0.6	0	0.1	0	0.3	✓	✓	✓
675	0.6	0	0	0.1	0.3	✓	✓	✓
676	0.5	0.2	0	0	0.3	✓	✓	✓
677	0.5	0.1	0.1	0	0.3	✓	✓	✓
678	0.5	0.1	0	0.1	0.3	✓	✓	✓
679	0.5	0	0.2	0	0.3	✓	✓	✓
680	0.5	0	0.1	0.1	0.3	✓	✓	✓
681	0.5	0	0	0.2	0.3	✓	✓	✓
682	0.4	0.3	0	0	0.3	✓	✓	✓
683	0.4	0.2	0.1	0	0.3	✓	✓	✓
684	0.4	0.2	0	0.1	0.3	✓	✓	✓
685	0.4	0.1	0.2	0	0.3	✓	✓	✓
686	0.4	0	0.2	0.1	0.3	✓	✓	✓
687	0.4	0.1	0	0.2	0.3	✓	✓	✓
688	0.4	0	0.1	0.2	0.3	✓	✓	✓
689	0.4	0.1	0.1	0.1	0.3	✓	✓	✓
690	0.4	0	0.3	0	0.3	✓	✓	✓
691	0.4	0	0	0.3	0.3	✓	✓	✓
692	0.3	0.4	0	0	0.3	✓	✓	✓
693	0.3	0.3	0.1	0	0.3	✓	✓	✓
694	0.3	0.3	0	0.1	0.3	✓	✓	✓
695	0.3	0.2	0.2	0	0.3	✓	✓	✓

696	0.3	0.2	0.1	0.1	0.3	✓	✓	✓
697	0.3	0.2	0	0.2	0.3	✓	✓	✓
698	0.3	0.1	0.3	0	0.3	✓	✓	✓
699	0.3	0.1	0.2	0.1	0.3	✓	✓	✓
700	0.3	0.1	0.1	0.2	0.3	✓	✓	✓
701	0.3	0.1	0	0.3	0.3	✓	✓	✓
702	0.3	0	0.4	0	0.3	✓	✓	✓
703	0.3	0	0.3	0.1	0.3	✓	✓	✓
704	0.3	0	0.2	0.2	0.3	✓	✓	✓
705	0.3	0	0.1	0.3	0.3	✓	✓	✓
706	0.3	0	0	0.4	0.3	✓	✓	✓
707	0.2	0.5	0	0	0.3	✓	✓	✓
708	0.2	0.4	0.1	0	0.3	✓	✓	✓
709	0.2	0.4	0	0.1	0.3	✓	✓	✓
710	0.2	0.3	0.2	0	0.3	✓	✓	✓
711	0.2	0.3	0.1	0.1	0.3	✓	✓	✓
712	0.2	0.3	0	0.2	0.3	✓	✓	✓
713	0.2	0.2	0.3	0	0.3	✓	✓	✓
714	0.2	0.2	0.2	0.1	0.3	✓	✓	✓
715	0.2	0.2	0.1	0.2	0.3	✓	✓	✓
716	0.2	0.2	0	0.3	0.3	✓	✓	✓
717	0.2	0.1	0.4	0	0.3	✓	✓	✓
718	0.2	0.1	0.3	0.1	0.3	✓	✓	✓
719	0.2	0.1	0.2	0.2	0.3	✓	✓	✓
720	0.2	0.1	0.1	0.3	0.3	✓	✓	✓
721	0.2	0.1	0	0.4	0.3	✓	✓	✓
722	0.2	0	0.5	0	0.3	✓	✓	✓
723	0.2	0	0.4	0.1	0.3	✓	✓	✓
724	0.2	0	0.3	0.2	0.3	✓	✓	✓
725	0.2	0	0.2	0.3	0.3	✓	✓	✓
726	0.2	0	0.1	0.4	0.3	✓	✓	✓
727	0.2	0	0	0.5	0.3	✓	✓	✓
728	0.1	0.6	0	0	0.3	✓	✓	✓
729	0.1	0.5	0.1	0	0.3	✓	✓	✓
730	0.1	0.5	0	0.1	0.3	✓	✓	✓
731	0.1	0.4	0.2	0	0.3	✓	✓	✓
732	0.1	0.4	0.1	0.1	0.3	✓	✓	✓
733	0.1	0.4	0	0.2	0.3	✓	✓	✓
734	0.1	0.3	0.3	0	0.3	✓	✓	✓
735	0.1	0.3	0.2	0.1	0.3	✓	✓	✓
736	0.1	0.3	0.1	0.2	0.3	✓	✓	✓
737	0.1	0.3	0	0.3	0.3	✓	✓	✓
738	0.1	0.2	0.4	0	0.3	✓	✓	✓
739	0.1	0.2	0.3	0.1	0.3	✓	✓	✓
740	0.1	0.2	0.2	0.2	0.3	✓	✓	✓
741	0.1	0.2	0.1	0.3	0.3	✓	✓	✓
742	0.1	0.2	0	0.4	0.3	✓	✓	✓

743	0.1	0.1	0.5	0	0.3	✓	✓	✓
744	0.1	0.1	0.4	0.1	0.3	✓	✓	✓
745	0.1	0.1	0.3	0.2	0.3	✓	✓	✓
746	0.1	0.1	0.2	0.3	0.3	✓	✓	✓
747	0.1	0.1	0.1	0.4	0.3	✓	✓	✓
748	0.1	0.1	0	0.5	0.3	✓	✓	✓
749	0.1	0	0.6	0	0.3	✓	✓	✓
750	0.1	0	0.5	0.1	0.3	✓	✓	✓
751	0.1	0	0.4	0.2	0.3	✓	✓	✓
752	0.1	0	0.3	0.3	0.3	✓	✓	✓
753	0.1	0	0.2	0.4	0.3	✓	✓	✓
754	0.1	0	0.1	0.5	0.3	✓	✓	✓
755	0.1	0	0	0.6	0.3	✓	✓	✓
756	0	0.7	0	0	0.3	✓	✓	✓
757	0	0.6	0.1	0	0.3	✓	✓	✓
758	0	0.6	0	0.1	0.3	✓	✓	✓
759	0	0.5	0.2	0	0.3	✓	✓	✓
760	0	0.5	0.1	0.1	0.3	✓	✓	✓
761	0	0.5	0	0.2	0.3	✓	✓	✓
762	0	0.4	0.3	0	0.3	✓	✓	✓
763	0	0.4	0.2	0.1	0.3	✓	✓	✓
764	0	0.4	0.1	0.2	0.3	✓	✓	✓
765	0	0.4	0	0.3	0.3	✓	✓	✓
766	0	0.3	0.4	0	0.3	✓	✓	✓
767	0	0.3	0.3	0.1	0.3	✓	✓	✓
768	0	0.3	0.2	0.2	0.3	✓	✓	✓
769	0	0.3	0.1	0.3	0.3	✓	✓	✓
770	0	0.3	0	0.4	0.3	✓	✓	✓
771	0	0.2	0.5	0	0.3	✓	✓	✓
772	0	0.2	0.4	0.1	0.3	✓	✓	✓
773	0	0.2	0.3	0.2	0.3	✓	✓	✓
774	0	0.2	0.2	0.3	0.3	✓	✓	✓
775	0	0.2	0.1	0.4	0.3	✓	✓	✓
776	0	0.2	0	0.5	0.3	✓	✓	✓
777	0	0.1	0.6	0	0.3	✓	✓	✓
778	0	0.1	0.5	0.1	0.3	✓	✓	✓
779	0	0.1	0.4	0.2	0.3	✓	✓	✓
780	0	0.1	0.3	0.3	0.3	✓	✓	✓
781	0	0.1	0.2	0.4	0.3	✓	✓	✓
782	0	0.1	0.1	0.5	0.3	✓	✓	✓
783	0	0.1	0	0.6	0.3	✓	✓	✓
784	0	0	0.7	0	0.3	✓	✓	✓
785	0	0	0.6	0.1	0.3	✓	✓	✓
786	0	0	0.5	0.2	0.3	✓	✓	✓
787	0	0	0.4	0.3	0.3	✓	✓	✓
788	0	0	0.3	0.4	0.3	✓	✓	✓
789	0	0	0.2	0.5	0.3	✓	✓	✓

790	0	0	0.1	0.6	0.3	✓	✓	✓
791	0	0	0	0.7	0.3	✓	✓	✓
792	0.6	0	0	0	0.4	✓	✓	✓
793	0.5	0.1	0	0	0.4	✓	✓	✓
794	0.5	0	0.1	0	0.4	✓	✓	✓
795	0.5	0	0	0.1	0.4	✓	✓	✓
796	0.4	0.2	0	0	0.4	✓	✓	✓
797	0.4	0.1	0.1	0	0.4	✓	✓	✓
798	0.4	0.1	0	0.1	0.4	✓	✓	✓
799	0.4	0	0.2	0	0.4	✓	✓	✓
800	0.4	0	0.1	0.1	0.4	✓	✓	✓
801	0.4	0	0	0.2	0.4	✓	✓	✓
802	0.3	0.3	0	0	0.4	✓	✓	✓
803	0.3	0.2	0.1	0	0.4	✓	✓	✓
804	0.3	0.2	0	0.1	0.4	✓	✓	✓
805	0.3	0.1	0.2	0	0.4	✓	✓	✓
806	0.3	0.1	0.1	0.1	0.4	✓	✓	✓
807	0.3	0.1	0	0.2	0.4	✓	✓	✓
808	0.3	0	0.3	0	0.4	✓	✓	✓
809	0.3	0	0.2	0.1	0.4	✓	✓	✓
810	0.3	0	0.1	0.2	0.4	✓	✓	✓
811	0.3	0	0	0.3	0.4	✓	✓	✓
812	0.2	0.4	0	0	0.4	✓	✓	✓
813	0.2	0.3	0.1	0	0.4	✓	✓	✓
814	0.2	0.3	0	0.1	0.4	✓	✓	✓
815	0.2	0.2	0.2	0	0.4	✓	✓	✓
816	0.2	0.2	0.1	0.1	0.4	✓	✓	✓
817	0.2	0.2	0	0.2	0.4	✓	✓	✓
818	0.2	0.1	0.3	0	0.4	✓	✓	✓
819	0.2	0.1	0.2	0.1	0.4	✓	✓	✓
820	0.2	0.1	0.1	0.2	0.4	✓	✓	✓
821	0.2	0.1	0	0.3	0.4	✓	✓	✓
822	0.2	0	0.4	0	0.4	✓	✓	✓
823	0.2	0	0.3	0.1	0.4	✓	✓	✓
824	0.2	0	0.2	0.2	0.4	✓	✓	✓
825	0.2	0	0.1	0.3	0.4	✓	✓	✓
826	0.2	0	0	0.4	0.4	✓	✓	✓
827	0.1	0.5	0	0	0.4	✓	✓	✓
828	0.1	0.4	0.1	0	0.4	✓	✓	✓
829	0.1	0.4	0	0.1	0.4	✓	✓	✓
830	0.1	0.3	0.2	0	0.4	✓	✓	✓
831	0.1	0.3	0.1	0.1	0.4	✓	✓	✓
832	0.1	0.3	0	0.2	0.4	✓	✓	✓
833	0.1	0.2	0.3	0	0.4	✓	✓	✓
834	0.1	0.2	0.2	0.1	0.4	✓	✓	✓
835	0.1	0.2	0.1	0.2	0.4	✓	✓	✓
836	0.1	0.2	0	0.3	0.4	✓	✓	✓

837	0.1	0.1	0.4	0	0.4	✓	✓	✓
838	0.1	0.1	0.3	0.1	0.4	✓	✓	✓
839	0.1	0.1	0.2	0.2	0.4	✓	✓	✓
840	0.1	0.1	0.1	0.3	0.4	✓	✓	✓
841	0.1	0.1	0	0.4	0.4	✓	✓	✓
842	0.1	0	0.5	0	0.4	✓	✓	✓
843	0.1	0	0.4	0.1	0.4	✓	✓	✓
844	0.1	0	0.3	0.2	0.4	✓	✓	✓
845	0.1	0	0.2	0.3	0.4	✓	✓	✓
846	0.1	0	0.1	0.4	0.4	✓	✓	✓
847	0.1	0	0	0.5	0.4	✓	✓	✓
848	0	0.6	0	0	0.4	✓	✓	✓
849	0	0.5	0.1	0	0.4	✓	✓	✓
850	0	0.5	0	0.1	0.4	✓	✓	✓
851	0	0.4	0.2	0	0.4	✓	✓	✓
852	0	0.4	0.1	0.1	0.4	✓	✓	✓
853	0	0.4	0	0.2	0.4	✓	✓	✓
854	0	0.3	0.3	0	0.4	✓	✓	✓
855	0	0.3	0.2	0.1	0.4	✓	✓	✓
856	0	0.3	0.1	0.2	0.4	✓	✓	✓
857	0	0.3	0	0.3	0.4	✓	✓	✓
858	0	0.2	0.4	0	0.4	✓	✓	✓
859	0	0.2	0.3	0.1	0.4	✓	✓	✓
860	0	0.2	0.2	0.2	0.4	✓	✓	✓
861	0	0.2	0.1	0.3	0.4	✓	✓	✓
862	0	0.2	0	0.4	0.4	✓	✓	✓
863	0	0.1	0.5	0	0.4	✓	✓	✓
864	0	0.1	0.4	0.1	0.4	✓	✓	✓
865	0	0.1	0.3	0.2	0.4	✓	✓	✓
866	0	0.1	0.2	0.3	0.4	✓	✓	✓
867	0	0.1	0.1	0.4	0.4	✓	✓	✓
868	0	0.1	0	0.5	0.4	✓	✓	✓
869	0	0	0.6	0	0.4	✓	✓	✓
870	0	0	0.5	0.1	0.4	✓	✓	✓
871	0	0	0.4	0.2	0.4	✓	✓	✓
872	0	0	0.3	0.3	0.4	✓	✓	✓
873	0	0	0.2	0.4	0.4	✓	✓	✓
874	0	0	0.1	0.5	0.4	✓	✓	✓
875	0	0	0	0.6	0.4	✓	✓	✓
876	0.5	0	0	0	0.5	✓	✓	✓
877	0.4	0.1	0	0	0.5	✓	✓	✓
878	0.4	0	0.1	0	0.5	✓	✓	✓
879	0.4	0	0	0.1	0.5	✓	✓	✓
880	0.3	0.2	0	0	0.5	✓	✓	✓
881	0.3	0.1	0.1	0	0.5	✓	✓	✓
882	0.3	0.1	0	0.1	0.5	✓	✓	✓
883	0.3	0	0.2	0	0.5	✓	✓	✓

884	0.3	0	0.1	0.1	0.5	✓	✓	✓
885	0.3	0	0	0.2	0.5	✓	✓	✓
886	0.2	0.3	0	0	0.5	✓	✓	✓
887	0.2	0.2	0.1	0	0.5	✓	✓	✓
888	0.2	0.2	0	0.1	0.5	✓	✓	✓
889	0.2	0.1	0.2	0	0.5	✓	✓	✓
890	0.2	0.1	0.1	0.1	0.5	✓	✓	✓
891	0.2	0.1	0	0.2	0.5	✓	✓	✓
892	0.2	0	0.3	0	0.5	✓	✓	✓
893	0.2	0	0.2	0.1	0.5	✓	✓	✓
894	0.2	0	0.1	0.2	0.5	✓	✓	✓
895	0.2	0	0	0.3	0.5	✓	✓	✓
896	0.1	0.4	0	0	0.5	✓	✓	✓
897	0.1	0.3	0.1	0	0.5	✓	✓	✓
898	0.1	0.3	0	0.1	0.5	✓	✓	✓
899	0.1	0.2	0.2	0	0.5	✓	✓	✓
900	0.1	0.2	0.1	0.1	0.5	✓	✓	✓
901	0.1	0.2	0	0.2	0.5	✓	✓	✓
902	0.1	0.1	0.3	0	0.5	✓	✓	✓
903	0.1	0.1	0.2	0.1	0.5	✓	✓	✓
904	0.1	0.1	0.1	0.2	0.5	✓	✓	✓
905	0.1	0.1	0	0.3	0.5	✓	✓	✓
906	0.1	0	0.4	0	0.5	✓	✓	✓
907	0.1	0	0.3	0.1	0.5	✓	✓	✓
908	0.1	0	0.2	0.2	0.5	✓	✓	✓
909	0.1	0	0.1	0.3	0.5	✓	✓	✓
910	0.1	0	0	0.4	0.5	✓	✓	✓
911	0	0.5	0	0	0.5	✓	✓	✓
912	0	0.4	0.1	0	0.5	✓	✓	✓
913	0	0.4	0	0.1	0.5	✓	✓	✓
914	0	0.3	0.2	0	0.5	✓	✓	✓
915	0	0.3	0.1	0.1	0.5	✓	✓	✓
916	0	0.3	0	0.2	0.5	✓	✓	✓
917	0	0.2	0.3	0	0.5	✓	✓	✓
918	0	0.2	0.2	0.1	0.5	✓	✓	✓
919	0	0.2	0.1	0.2	0.5	✓	✓	✓
920	0	0.2	0	0.3	0.5	✓	✓	✓
921	0	0.1	0.4	0	0.5	✓	✓	✓
922	0	0.1	0.3	0.1	0.5	✓	✓	✓
923	0	0.1	0.2	0.2	0.5	✓	✓	✓
924	0	0.1	0.1	0.3	0.5	✓	✓	✓
925	0	0.1	0	0.4	0.5	✓	✓	✓
926	0	0	0.5	0	0.5	✓	✓	✓
927	0	0	0.4	0.1	0.5	✓	✓	✓
928	0	0	0.3	0.2	0.5	✓	✓	✓
929	0	0	0.2	0.3	0.5	✓	✓	✓
930	0	0	0.1	0.4	0.5	✓	✓	✓

931	0	0	0	0.5	0.5	✓	✓	✓
932	0.4	0	0	0	0.6	✓	✓	
933	0.3	0.1	0	0	0.6	✓	✓	
934	0.3	0	0.1	0	0.6	✓	✓	
935	0.3	0	0	0.1	0.6	✓	✓	
936	0.2	0.2	0	0	0.6	✓	✓	
937	0.2	0.1	0.1	0	0.6	✓	✓	
938	0.2	0.1	0	0.1	0.6	✓	✓	
939	0.2	0	0.2	0	0.6	✓	✓	
940	0.2	0	0.1	0.1	0.6	✓	✓	
941	0.2	0	0	0.2	0.6	✓	✓	
942	0.1	0.3	0	0	0.6	✓	✓	
943	0.1	0.2	0.1	0	0.6	✓	✓	
944	0.1	0.2	0	0.1	0.6	✓	✓	
945	0.1	0.1	0.2	0	0.6	✓	✓	
946	0.1	0.1	0.1	0.1	0.6	✓	✓	
947	0.1	0.1	0	0.2	0.6	✓	✓	
948	0.1	0	0.3	0	0.6	✓	✓	
949	0.1	0	0.2	0.1	0.6	✓	✓	
950	0.1	0	0.1	0.2	0.6	✓	✓	
951	0.1	0	0	0.3	0.6	✓	✓	
952	0	0.4	0	0	0.6	✓	✓	
953	0	0.3	0.1	0	0.6	✓	✓	
954	0	0.3	0	0.1	0.6	✓	✓	
955	0	0.2	0.2	0	0.6	✓	✓	
956	0	0.2	0.1	0.1	0.6	✓	✓	
957	0	0.2	0	0.2	0.6	✓	✓	
958	0	0.1	0.3	0	0.6	✓	✓	
959	0	0.1	0.2	0.1	0.6	✓	✓	
960	0	0.1	0.1	0.2	0.6	✓	✓	
961	0	0.1	0	0.3	0.6	✓	✓	
962	0	0	0.4	0	0.6	✓	✓	
963	0	0	0.3	0.1	0.6	✓	✓	
964	0	0	0.2	0.2	0.6	✓	✓	
965	0	0	0.1	0.3	0.6	✓	✓	
966	0	0	0	0.4	0.6	✓	✓	
967	0.3	0	0	0	0.7	✓	✓	
968	0.2	0.1	0	0	0.7	✓	✓	
969	0.2	0	0.1	0	0.7	✓	✓	
970	0.2	0	0	0.1	0.7	✓	✓	
971	0.1	0.2	0	0	0.7	✓	✓	
972	0.1	0.1	0.1	0	0.7	✓	✓	
973	0.1	0.1	0	0.1	0.7	✓	✓	
974	0.1	0	0.2	0	0.7	✓	✓	
975	0.1	0	0.1	0.1	0.7	✓	✓	
976	0.1	0	0	0.2	0.7	✓	✓	
977	0	0.3	0	0	0.7	✓	✓	

978	0	0.2	0.1	0	0.7	✓	✓	
979	0	0.2	0	0.1	0.7	✓	✓	
980	0	0.1	0.2	0	0.7	✓	✓	
981	0	0.1	0.1	0.1	0.7	✓	✓	
982	0	0.1	0	0.2	0.7	✓	✓	
983	0	0	0.3	0	0.7	✓	✓	
984	0	0	0.2	0.1	0.7	✓	✓	
985	0	0	0.1	0.2	0.7	✓	✓	
986	0	0	0	0.3	0.7	✓	✓	
987	0.2	0	0	0	0.8	✓	✓	
988	0.1	0.1	0	0	0.8	✓	✓	
989	0.1	0	0.1	0	0.8	✓	✓	
990	0.1	0	0	0.1	0.8	✓	✓	
991	0	0.2	0	0	0.8	✓	✓	
992	0	0.1	0.1	0	0.8	✓	✓	
993	0	0.1	0	0.1	0.8	✓	✓	
994	0	0	0.2	0	0.8	✓	✓	
995	0	0	0.1	0.1	0.8	✓	✓	
996	0	0	0	0.2	0.8	✓	✓	
997	0.1	0	0	0	0.9	✓		
998	0	0.1	0	0	0.9	✓		
999	0	0	0.1	0	0.9	✓		
1000	0	0	0	0.1	0.9	✓		
1001	0	0	0	0	1			

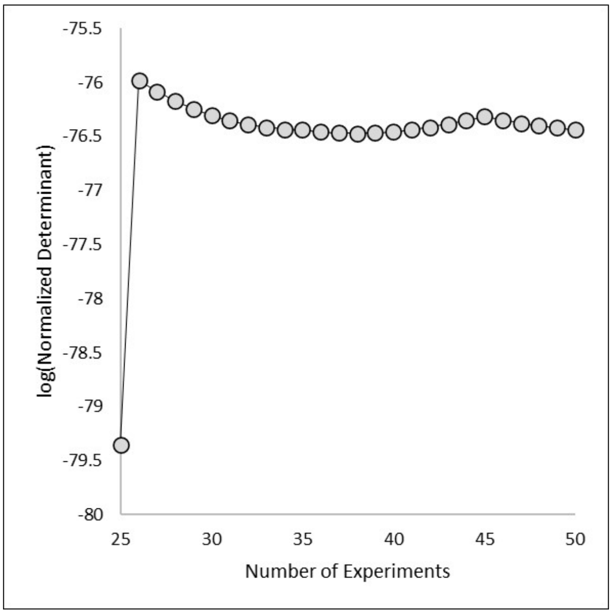


Figure S1. Normalized determinant vs. the number of experiments for D-Optimal Design application on candidate points matrix in Table S1, assuming model equation reported in Equation 1.

Table S2. 26-experiments *training set* extracted by D-Optimal Design from the complete cp in Table S1, assuming model equation reported in Equation 1.

Sample	Formula	Cr	Mn	Fe	Co	M	% Perovskite
P1	$LaCrO_3$	1	0	0	0	0	100%
P2	$La(CrMn)_{0.5}O_3$	0.5	0.5	0	0	0	100%
P3	$La(CrFe)_{0.5}O_3$	0.5	0	0.5	0	0	100%
P4	$La(CrCo)_{0.5}O_3$	0.5	0	0	0.5	0	100%
P5	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	100%
P6	$LaMn_{0.4}(CrFe)_{0.3}O_3$	0.3	0.4	0.3	0	0	100%
P7	$LaMn_{0.4}(CrCo)_{0.3}O_3$	0.3	0.4	0	0.3	0	100%
P8	$LaMnO_3$	0	1	0	0	0	100%
P9	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	100%
P10	$La(MnFe)_{0.5}O_3$	0	0.5	0	0.5	0	100%
P11	$LaMn_{0.4}(FeCo)_{0.3}O_3$	0	0.4	0.3	0.3	0	100%
P12	$LaFeO_3$	0	0	1	0	0	100%
P13	$La(FeCo)_{0.5}O_3$	0	0	0.5	0.5	0	100%
P14	$LaCoO_3$	0	0	0	1	0	100%
PN1/PZ1	$LaMn_{0.4}(CrNi)_{0.3}O_3/LaMn_{0.4}(CrZn)_{0.3}O_3$	0.3	0.4	0	0	0.3	100%
PN2/PZ2	$LaCo_{0.4}(CrNi)_{0.3}O_3/LaCo_{0.4}(CrZn)_{0.3}O_3$	0.3	0	0	0.4	0.3	100% /94.13%
PN3/PZ3	$LaCo_{0.4}(MnNi)_{0.3}O_3/LaCo_{0.4}(MnZn)_{0.3}O_3$	0	0.3	0	0.4	0.3	100%/95.04%
PN4/PZ4	$LaFe_{0.4}(CoNi)_{0.3}O_3/LaFe_{0.4}(CoZn)_{0.3}O_3$	0	0	0.4	0.3	0.3	100%/83.04%
PN5/PZ5	$LaNi_{0.4}(CrFe)_{0.3}O_3/LaNi_{0.4}(CrFe)_{0.3}O_3$	0.3	0	0.3	0	0.4	100%/85.26%
PN6/PZ6	$LaNi_{0.4}(CrCo)_{0.3}O_3/LaZn_{0.4}(CrCo)_{0.3}O_3$	0.3	0	0	0.3	0.4	100%/80.62%

PN7/PZ7	$LaNi_{0.4}(MnFe)_{0.3}O_3/LaZn_{0.4}(MnFe)_{0.3}O_3$	0	0.3	0.3	0	0.4	100%/90.89%
PN8/PZ8	$La(CrNi)_{0.5}O_3/La(CrZn)_{0.5}O_3$	0.5	0	0	0	0.5	100%/78.12%
PN9/PZ9	$La(MnNi)_{0.5}O_3/La(MnZn)_{0.5}O_3$	0	0.5	0	0	0.5	100%
PN10/PZ10	$La(FeNi)_{0.5}O_3/La(FeZn)_{0.5}O_3$	0	0	0.5	0	0.5	100%/70.10%
PN11/PZ11	$La(CoNi)_{0.5}O_3/La(CoZn)_{0.5}O_3$	0	0	0	0.5	0.5	100%/39.68%
PN12/PZ12	$LaNiO_3$ /$LaZnO_3$	0	0	0	0	1	0%

Table S3. 35-experiments expanded *training set* for Ni-containing perovskites obtained by adding further experiments to the *training set* in Table S2 extracted from the reduced cps (Stability domain estimation Table S1, seventh and eighth columns) by D-Optimal Design by Addition.

Sample	Formula	Cr	Mn	Fe	Co	Ni	% Perovskite	Cp
P1	$LaCrO_3$	1	0	0	0	0	100%	Complete
P2	$La(CrMn)_{0.5}O_3$	0.5	0.5	0	0	0	100%	Complete
P3	$La(CrFe)_{0.5}O_3$	0.5	0	0.5	0	0	100%	Complete
P4	$La(CrCo)_{0.5}O_3$	0.5	0	0	0.5	0	100%	Complete
P5	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	100%	Complete
P6	$LaMn_{0.4}(CrFe)_{0.3}O_3$	0.3	0.4	0.3	0	0	100%	Complete
P7	$LaMn_{0.4}(CrCo)_{0.3}O_3$	0.3	0.4	0	0.3	0	100%	Complete
P8	$LaMnO_3$	0	1	0	0	0	100%	Complete
P9	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	100%	Complete
P10	$La(MnFe)_{0.5}O_3$	0	0.5	0	0.5	0	100%	Complete
P11	$LaMn_{0.4}(FeCo)_{0.3}O_3$	0	0.4	0.3	0.3	0	100%	Complete
P12	$LaFeO_3$	0	0	1	0	0	100%	Complete
P13	$La(FeCo)_{0.5}O_3$	0	0	0.5	0.5	0	100%	Complete
P14	$LaCoO_3$	0	0	0	1	0	100%	Complete
PN1	$LaMn_{0.4}(CrNi)_{0.3}O_3$	0.3	0.4	0	0	0.3	100%	Complete
PN2	$LaCo_{0.4}(CrNi)_{0.3}O_3$	0.3	0	0	0.4	0.3	100%	Complete
PN3	$LaCo_{0.4}(MnNi)_{0.3}O_3$	0	0.3	0	0.4	0.3	100%	Complete
PN4	$LaFe_{0.4}(CoNi)_{0.3}O_3$	0	0	0.4	0.3	0.3	100%	Complete
PN5	$LaNi_{0.4}(CrFe)_{0.3}O_3$	0.3	0	0.3	0	0.4	100%	Complete
PN6	$LaNi_{0.4}(CrCo)_{0.3}O_3$	0.3	0	0	0.3	0.4	100%	Complete
PN7	$LaNi_{0.4}(MnFe)_{0.3}O_3$	0	0.3	0.3	0	0.4	100%	Complete
PN8	$La(CrNi)_{0.5}O_3$	0.5	0	0	0	0.5	100%	Complete
PN9	$La(MnNi)_{0.5}O_3$	0	0.5	0	0	0.5	100%	Complete
PN10	$La(FeNi)_{0.5}O_3$	0	0	0.5	0	0.5	100%	Complete
PN11	$La(CoNi)_{0.5}O_3$	0	0	0	0.5	0.5	100%	Complete
PN12	$La_4Ni_3O_{10}$	0	0	0	0	1	0%	Complete

PN13	$LaMn_{0.1}Ni_{0.9}O_3$	0	0.1	0	0	0.9	90.58%	Ni≤0.9
PN14	$LaFe_{0.1}Ni_{0.9}O_3$	0	0	0.1	0	0.9	90.31%	Ni≤0.9
PN15	$LaFe_{0.4}Co_{0.1}Ni_{0.5}O_3$	0	0	0.4	0.1	0.5	100%	Ni≤0.8
PN16	$LaFe_{0.1}Co_{0.4}Ni_{0.5}O_4$	0	0	0.1	0.4	0.5	100%	Ni≤0.8
PN17	$La(CrMn)_{0.1}Co_{0.2}Ni_{0.6}O_3$	0.1	0.1	0	0.2	0.6	100%	Ni≤0.8
PN18	$LaFe_{0.1}Co_{0.3}Ni_{0.6}O_3$	0	0	0.1	0.3	0.6	100%	Ni≤0.8
PN19	$La(FeCo)_{0.2}Ni_{0.6}O_3$	0	0	0.2	0.2	0.6	100%	Ni≤0.8
PN20	$LaMn_{0.2}Co_{0.1}Ni_{0.7}O_3$	0	0.2	0	0.1	0.7	100%	Ni≤0.8
PN21	$LaCr_{0.2}Ni_{0.8}O_3$	0.2	0	0	0	0.8	100%	Ni≤0.8

Table S4. 45-experiments expanded *training set* for Zn-containing perovskites obtained by adding further experiments to the *training set* in Table S2 extracted from the reduced cps (Stability domain estimation Table S1, last column) by D-Optimal Design by Addition.

Sample	**Formula**	**Cr**	**Mn**	**Fe**	**Co**	**Zn**	**% Perovskite**	**Cp**
P1	$LaCrO_3$	1	0	0	0	0	100%	Complete
P2	$La(CrMn)_{0.5}O_3$	0.5	0.5	0	0	0	100%	Complete
P3	$La(CrFe)_{0.5}O_3$	0.5	0	0.5	0	0	100%	Complete
P4	$La(CrCo)_{0.5}O_3$	0.5	0	0	0.5	0	100%	Complete
P5	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	100%	Complete
P6	$LaMn_{0.4}(CrFe)_{0.3}O_3$	0.3	0.4	0.3	0	0	100%	Complete
P7	$LaMn_{0.4}(CrCo)_{0.3}O_3$	0.3	0.4	0	0.3	0	100%	Complete
P8	$LaMnO_3$	0	1	0	0	0	100%	Complete
P9	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	100%	Complete
P10	$La(MnFe)_{0.5}O_3$	0	0.5	0	0.5	0	100%	Complete
P11	$LaMn_{0.4}(FeCo)_{0.3}O_3$	0	0.4	0.3	0.3	0	100%	Complete
P12	$LaFeO_3$	0	0	1	0	0	100%	Complete
P13	$La(FeCo)_{0.5}O_3$	0	0	0.5	0.5	0	100%	Complete
P14	$LaCoO_3$	0	0	0	1	0	100%	Complete
PZ1	$LaMn_{0.4}(CrZn)_{0.3}O_3$	0.3	0.4	0	0	0.3	100%	Complete
PZ2	$LaCo_{0.4}(CrZn)_{0.3}O_3$	0.3	0	0	0.4	0.3	94.13%	Complete
PZ3	$LaCo_{0.4}(MnZn)_{0.3}O_3$	0	0.3	0	0.4	0.3	95.04%	Complete
PZ4	$LaFe_{0.4}(CoZn)_{0.3}O_3$	0	0	0.4	0.3	0.3	83.04%	Complete
PZ5	$LaNi_{0.4}(CrFe)_{0.3}O_3$	0.3	0	0.3	0	0.4	85.26%	Complete
PZ6	$LaZn_{0.4}(CrCo)_{0.3}O_3$	0.3	0	0	0.3	0.4	80.62%	Complete
PZ7	$LaZn_{0.4}(MnFe)_{0.3}O_3$	0	0.3	0.3	0	0.4	90.89%	Complete
PZ8	$La(CrZn)_{0.5}O_3$	0.5	0	0	0	0.5	78.12%	Complete
PZ9	$La(MnZn)_{0.5}O_3$	0	0.5	0	0	0.5	100%	Complete
PZ10	$La(FeZn)_{0.5}O_3$	0	0	0.5	0	0.5	70.10%	Complete

PZ11	$La(CoZn)_{0.5}O_3$	0	0	0	0.5	0.5	39.68%	Complete
PZ12	$LaZnO_3$	0	0	0	0	1	0%	Complete
P15	$LaMn_{0.6}Co_{0.4}O_3$	0	0.6	0	0.4	0	100%	Zn≤0.5
P16	$LaMn_{0.1}Fe_{0.9}O_3$	0	0.1	0.9	0	0	100%	Zn≤0.5
P17	$LaMn_{0.1}Fe_{0.4}Co_{0.5}O_3$	0	0.1	0.4	0.5	0	100%	Zn≤0.5
P18	$LaMn_{0.1}Co_{0.9}O_3$	0	0.1	0	0.9	0	100%	Zn≤0.5
PZ13	$LaCr_{0.3}Mn_{0.5}Zn_{0.2}O_3$	0.3	0.5	0	0	0.2	100%	Zn≤0.5
PZ14	$LaCr_{0.3}Fe_{0.4}Co_{0.1}Zn_{0.2}O_3$	0.3	0	0.4	0.1	0.2	100%	Zn≤0.5
PZ15	$LaMn_{0.7}Fe_{0.1}Zn_{0.2}O_3$	0	0.7	0.1	0	0.2	100%	Zn≤0.5
PZ16	$LaCr_{0.7}Zn_{0.3}O_3$	0.7	0	0	0	0.3	100%	Zn≤0.5
PZ17	$LaCr_{0.4}(FeZn)_{0.3}O_3$	0.4	0	0.3	0	0.3	100%	Zn≤0.5
PZ18	$La(CrMn)_{0.3}Fe_{0.1}Zn_{0.3}O_3$	0.3	0.3	0.1	0	0.3	100%	Zn≤0.5
PZ19	$La(CrFe)_{0.1}Co_{0.5}Zn_{0.3}O_3$	0.1	0	0.1	0.5	0.3	83.76%	Zn≤0.5
PZ20	$LaMn_{0.1}Fe_{0.6}Zn_{0.3}O_3$	0	0.1	0.6	0	0.3	79.22%	Zn≤0.5
PZ21	$LaMn_{0.4}(CoZn)_{0.3}O_3$	0	0.4	0	0.3	0.3	100%	Zn≤0.5
PZ22	$LaMn_{0.1}Fe_{0.2}Co_{0.4}Zn_{0.3}O_3$	0	0.1	0.2	0.4	0.3	92.6%	Zn≤0.5
PZ23	$LaMn_{0.1}Co_{0.6}Zn_{0.3}O_3$	0	0.1	0	0.6	0.3	83.19%	Zn≤0.5
PZ24	$LaCr_{0.3}Mn_{0.2}Co_{0.1}Zn_{0.3}O_3$	0.3	0.2	0	0.1	0.4	100%	Zn≤0.5
PZ25	$LaMn_{0.5}Co_{0.1}Zn_{0.4}O_3$	0	0.5	0	0.1	0.4	100%	Zn≤0.5
PZ26	$LaCr_{0.1}Fe_{0.4}Zn_{0.5}O_3$	0.1	0	0.4	0	0.5	60.77%	Zn≤0.5
PZ27	$LaMn_{0.1}Co_{0.4}Zn_{0.5}O_3$	0	0.1	0	0.4	0.5	58.68%	Zn≤0.5

Table S5. Numerical value calculated for each coefficient in the model equation referring to Zn solubility in the perovskite system, together with its standard deviation, confidence interval, p-value and significance.

Coefficient	Calculated value	Standard deviation	Confidence Interval	p-value	Significance
Cr	101.4	4.6	9.5	0.000	***
Mn	97.7	4.4	9.3	0.000	***
Fe	99.7	3.8	8.0	0.000	***
Co	101.0	3.8	7.9	0.000	***
Zn	-0.3	4.6	9.6	0.950	
Cr*Mn	-4.5	22.2	46.3	0.840	
Cr*Fe	1.2	22.1	46.0	0.958	
Cr*Co	-5.0	22.0	45.8	0.823	
Cr*Zn	123.5	20.2	42.1	0.000	***
Mn*Fe	0.1	22.8	47.5	0.997	
Mn*Co	1.4	18.8	39.1	0.943	
Mn*Zn	187.5	20.9	43.5	0.000	***
Fe*Co	-4.0	19.8	41.4	0.844	
Fe*Zn	50.8	19.5	40.7	0.017	*
Co*Zn	-31.8	19.5	40.7	0.118	
Cr*Mn*Fe	34.5	159.1	331.9	0.831	
Cr*Mn*Co	51.0	155.7	324.7	0.746	
Cr*Mn*Zn	-40.4	118.7	247.5	0.737	
Cr*Fe*Co	7.5	157.0	327.5	0.962	
Cr*Fe*Zn	138.7	120.4	251.1	0.263	
Cr*Co*Zn	393.2	123.4	257.5	0.005	**
Mn*Fe*Co	45.2	151.2	315.5	0.768	
Mn*Fe*Zn	-11.5	146.2	305.0	0.938	
Mn*Co*Zn	366.6	124.2	259.2	0.008	**
Fe*Co*Zn	376.7	129.4	270.0	0.009	**

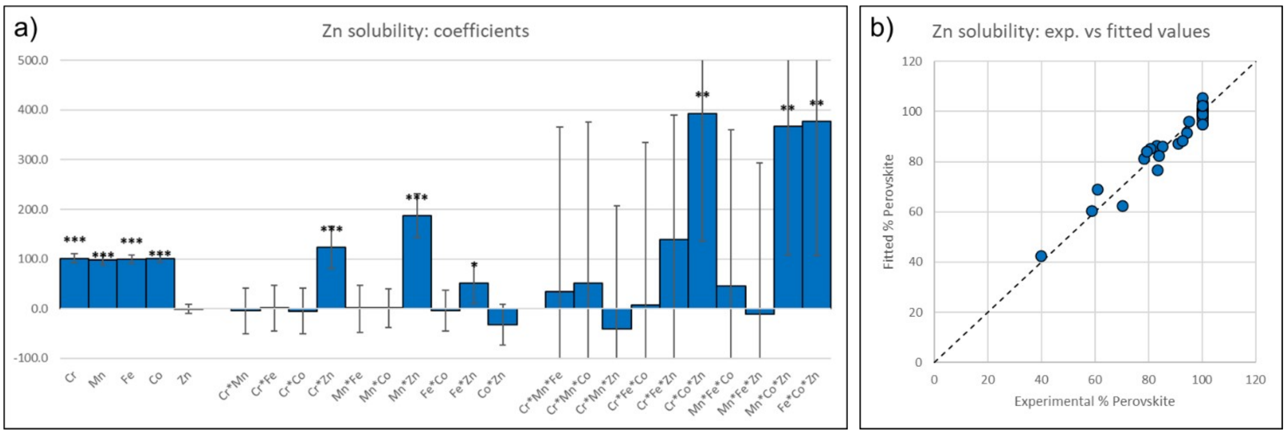


Figure S2. a) Coefficients plot for Zn solubility, confidence interval estimated using standard deviations from residuals and significance (***: 99.9 %, **: 99 %, *: 95 % confidence level); b) Experimental (x) vs. fitted (y) values for Zn solubility in the perovskite system.

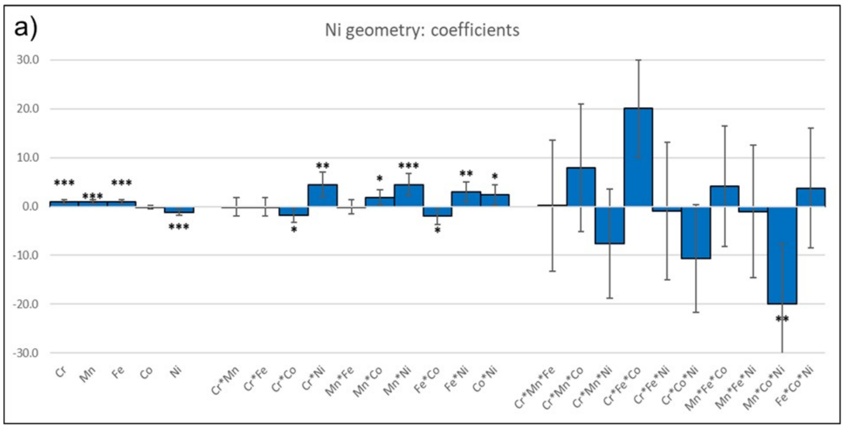
Table S6. Validation samples for modelling Zn solubility in perovskite system

Sample	Formula	Cr	Mn	Fe	Co	Zn	% Perovskite
P19	$La(CrMnFeCo)_{0.25}O_3$	0.25	0.25	0.25	0.25	0	100%
PZ26	$La(CrMnFeCoZn)_{0.2}O_3$	0.2	0.2	0.2	0.2	0.2	100%
PZ27	$La(CrMnFeZn)_{0.25}O_3$	0.25	0.25	0.25	0	0.25	100%
PZ28	$La(CrMnCoZn)_{0.25}O_3$	0.25	0.25	0	0.25	0.25	100%
PZ29	$La(CrFeCoZn)_{0.25}O_3$	0.25	0	0.25	0.25	0.25	100%
PZ30	$La(MnFeCoZn)_{0.25}O_3$	0	0.25	0.25	0.25	0.25	100%

Table S7. Numerical value calculated for each coefficient in the model equation referring to Ni-containing perovskites crystal system, together with its standard deviation, confidence interval, p-value and significance.

Coefficient	Calculated value	Standard deviation	Confidence Interval	p-value	Significance
Cr	1.0	0.2	0.4	0.000	***
Mn	1.0	0.2	0.4	0.000	***
Fe	1.0	0.2	0.3	0.000	***
Co	-0.1	0.2	0.3	0.432	
Ni	-1.2	0.3	0.6	0.001	***
Cr*Mn	-0.1	0.9	1.9	0.951	
Cr*Fe	0.0	0.9	1.9	0.968	
Cr*Co	-1.8	0.7	1.5	0.025	*
Cr*Ni	4.5	1.2	2.6	0.001	**
Mn*Fe	-0.1	0.7	1.4	0.942	
Mn*Co	1.9	0.7	1.5	0.015	*
Mn*Ni	4.5	1.1	2.2	0.000	***
Fe*Co	-2.0	0.8	1.7	0.025	*
Fe*Ni	3.0	1.0	2.0	0.006	**
Co*Ni	2.4	1.0	2.1	0.028	*
Cr*Mn*Fe	0.2	6.5	13.4	0.978	
Cr*Mn*Co	7.9	6.3	13.1	0.221	
Cr*Mn*Ni	-7.6	5.4	11.2	0.174	
Cr*Fe*Co	20.1	4.8	9.9	0.000	
Cr*Fe*Ni	-0.9	6.8	14.1	0.895	
Cr*Co*Ni	-10.6	5.3	11.0	0.059	
Mn*Fe*Co	4.2	6.0	12.3	0.489	
Mn*Fe*Ni	-1.0	6.6	13.6	0.875	
Mn*Co*Ni	-20.0	6.0	12.4	0.003	**
Fe*Co*Ni	3.8	5.9	12.3	0.533	

Figure S3. a) Coefficients plot for Ni-containing perovskites crystal system, confidence interval estimated using standard deviations from residuals and significance (***: 99.9 %, **: 99 %, *: 95 % confidence level); experimental (columns) vs. fitted (rows) values Ni-containing perovskites crystal system for the training (b) and validation (c) samples.



b) Experimental (columns) vs. fitted (rows) for training samples

	Orthorhombic	Trigonal
Orthorhombic	26	0
Trigonal	0	20
Not assigned	1	1

c) Experimental (columns) vs. fitted (rows) for validation samples

	Orthorhombic	Trigonal
Orthorhombic	8	0
Trigonal	0	3
Not assigned	1	1

Table S8. Numerical value calculated for each coefficient in the model equation referring to oxygen non-stoichiometry for Ni-containing perovskites, together with its standard deviation, confidence interval, p-value and significance.

Coefficient	Calculated value	Standard deviation	Confidence Interval	p-value	Significance
Cr	0.003	0.005	0.010	0.591	
Mn	0.008	0.005	0.010	0.121	
Fe	0.004	0.004	0.008	0.364	
Co	-0.001	0.004	0.008	0.851	
Ni	-0.006	0.008	0.016	0.453	
Cr*Mn	0.003	0.024	0.049	0.912	
Cr*Fe	-0.005	0.023	0.048	0.842	
Cr*Co	0.103	0.019	0.039	0.000	***
Cr*Ni	0.024	0.031	0.065	0.457	
Mn*Fe	0.056	0.018	0.036	0.004	**
Mn*Co	0.041	0.018	0.038	0.036	*
Mn*Zn	0.009	0.028	0.057	0.741	
Fe*Co	0.073	0.021	0.043	0.002	**
Fe*Ni	0.055	0.025	0.052	0.037	*
Co*Ni	0.062	0.026	0.053	0.024	*
Cr*Mn*Fe	-0.019	0.165	0.340	0.910	
Cr*Mn*Co	-0.446	0.160	0.332	0.011	*
Cr*Mn*Ni	-0.026	0.138	0.285	0.849	
Cr*Fe*Co	-0.425	0.122	0.252	0.002	**
Cr*Fe*Ni	-0.101	0.173	0.358	0.565	
Cr*Co*Ni	-0.387	0.135	0.280	0.009	**
Mn*Fe*Co	-0.618	0.151	0.313	0.001	***
Mn*Fe*Ni	-0.304	0.166	0.344	0.081	
Mn*Co*Ni	0.090	0.153	0.315	0.560	
Fe*Co*Ni	-0.377	0.151	0.312	0.020	*

Figure S4. a) Coefficients plot for oxygen non-stoichiometry for Ni-containing perovskites, confidence interval estimated using standard deviations from residuals and significance (***: 99.9 %, **: 99 %, *: 95 % confidence level); b) Experimental (x) vs. fitted (y) values for oxygen non-stoichiometry for Ni-containing perovskites.

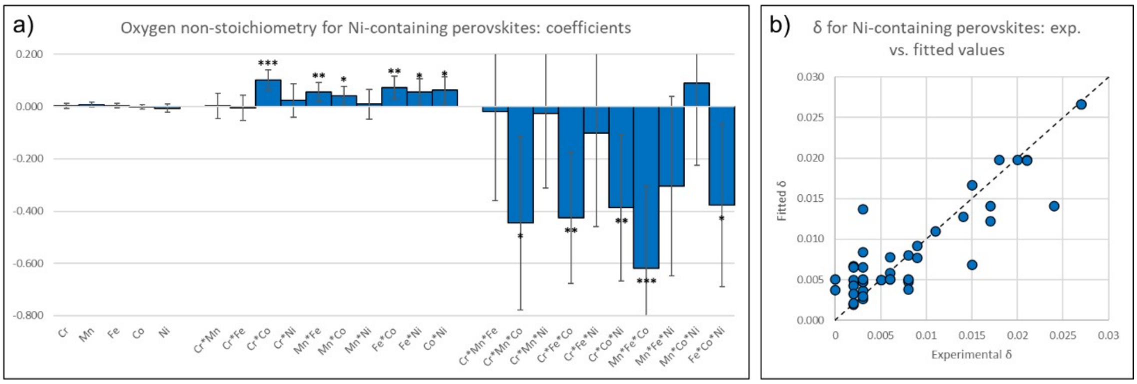
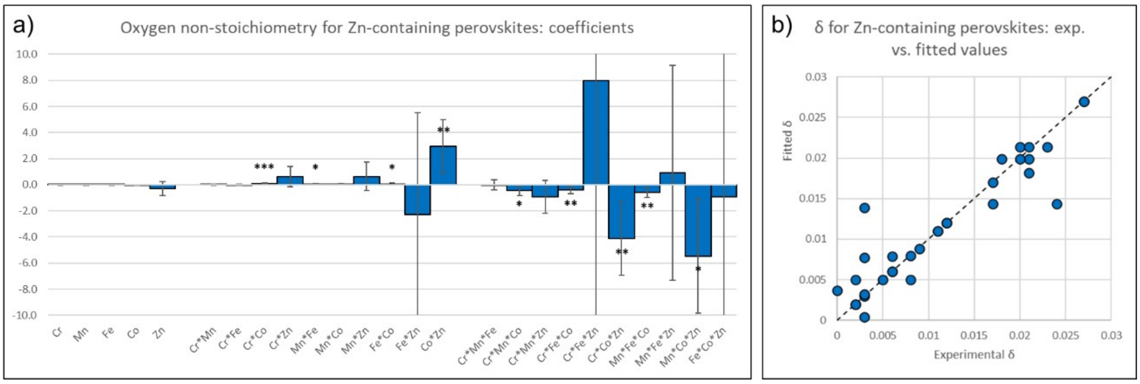


Table S9. Numerical value calculated for each coefficient in the model equation referring to oxygen non-stoichiometry for Zn-containing perovskites, together with its standard deviation, confidence interval, p-value and significance.

Coefficient	Calculated value	Standard deviation	Confidence Interval	p-value	Significance
Cr	0.003	0.005	0.012	0.590	
Mn	0.008	0.005	0.012	0.162	
Fe	0.003	0.005	0.010	0.484	
Co	-0.001	0.004	0.009	0.833	
Zn	-0.309	0.251	0.536	0.238	
Cr*Mn	0.002	0.027	0.057	0.937	
Cr*Fe	-0.004	0.026	0.055	0.868	
Cr*Co	0.104	0.021	0.044	0.000	***
Cr*Zn	0.612	0.361	0.769	0.110	
Mn*Fe	0.057	0.020	0.042	0.010	*
Mn*Co	0.041	0.020	0.043	0.060	
Mn*Zn	0.649	0.504	1.074	0.217	
Fe*Co	0.068	0.023	0.049	0.010	*
Fe*Zn	-2.299	3.673	7.829	0.541	
Co*Zn	2.954	0.964	2.055	0.008	**
Cr*Mn*Fe	-0.021	0.183	0.391	0.911	
Cr*Mn*Co	-0.455	0.180	0.383	0.023	*
Cr*Mn*Zn	-0.937	0.591	1.260	0.134	
Cr*Fe*Co	-0.415	0.136	0.290	0.008	**
Cr*Fe*Zn	7.984	10.004	21.323	0.437	
Cr*Co*Zn	-4.137	1.320	2.813	0.007	**
Mn*Fe*Co	-0.595	0.169	0.359	0.003	**
Mn*Fe*Zn	0.922	3.870	8.250	0.815	

Mn*Co*Zn	-5.459	2.059	4.388	0.018	*
Fe*Co*Zn	-0.922	7.514	16.015	0.904	

Figure S5. a) Coefficients plot for oxygen non-stoichiometry for Zn-containing perovskites, confidence interval estimated using standard deviations from residuals and significance (***: 99.9 %, **: 99 %, *: 95 % confidence level); b) Experimental (x) vs. fitted (y) values for oxygen non-stoichiometry for Zn-containing perovskites.



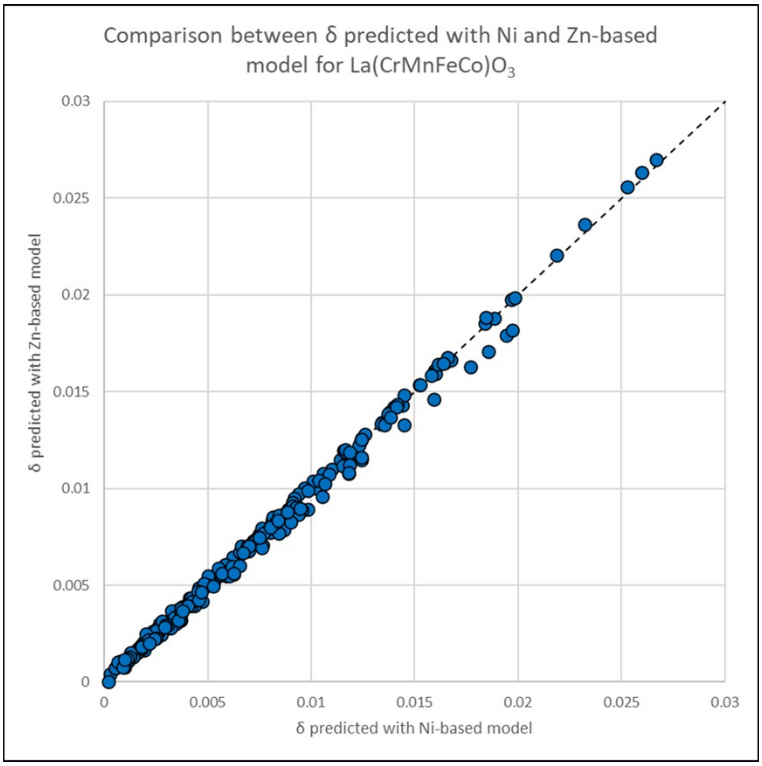


Figure S6. Comparison between δ values predicted for $La(CrMnFeCo)O_3$ perovskites using polynomial model based on $La(CrMnFeCoNi)O_3$ (x) and $La(CrMnFeCoZn)O_3$ (y) systems.

Experimental Conditions

Sample Synthesis

All samples were synthesized by a sol-gel method. The precursors were purchased from Sigma-Aldrich: $La(NO_3)_3*6H_2O$ (99.999%), $Cr(NO_3)_3*9H_2O$ (99.99%), $Mn(NO_3)_2*4H_2O$ (99.99%), $Fe(NO_3)_3*9H_2O$ (99.95%), $Co(NO_3)_2*6H_2O$ (99.999%), $Ni(NO_3)_2*6H_2O$(99.999%), $Zn(NO_3)_2$ (≥99.0%), citric acid anhydrous (≥99.5%) and ethylene glycol anhydrous (≥99%). The stoichiometric amount of nitrate salts of the cations was weighed and dissolved in a 50 mL aqueous solution. An equivalent quantity of 1:2.5 citric acid and 1:1 ethylene glycol was added to the solution. The solution was stirred at 130°C until gelling. The gel was treated in an oven at 230°C for 2 hours to completely remove the nitrates. The collected powder was calcined in a muffle furnace at 750°C for 6h. Finally, the collected powder was pelleted and sintered on a platinum crucible in an oven at 1100°C for 12h.

Characterization

The crystal structure of the samples has been characterized by room temperature Cu-K and Mo-K radiation XRD acquired with Bruker D2 and D8 Advances diffractometers. Diffraction experiments were carried out in flat-plate mode by using null-background sample holders. Crystal structure information was obtained through the Rietveld method performed using fullprof software.

X-ray fluorescence (XRF) analysis was performed using the AXIOS spectrometer (Panalytical) equipped with an Rh-anode X-ray tube with maximum power of 2.4 kW. The wavelength dispersive system of the spectrometer used five crystals (LiF (2 0 0), Ge (1 1 1), PE (0 0 2), PX1 and LiF (2 2 0)), which were automatically selected during the measurements. The characteristic X-rays induced in the sample were diffracted on one of the crystals and measured by a scintillation detector. The measurements were performed in helium. The quantitative analysis of the spectra was performed with the PANalytical analytical program Omnian. The Omnian package is available for the standardless analysis of all types of samples. Omnian includes advanced algorithms designed to profile known limitations inherent to XRF and includes spectral interference. Experimental stoichiometries were found to be in very good agreement (within the e.s.d.) with the nominal ones which have been therefore used throughout the paper.

The non-stoichiometry of the samples was obtained by thermogravimetric analysis using the formula (1).

$$\delta = \frac{\Delta_{\%m} * PM_{PVK}}{PM_{O2} * 3 * 100} \tag{1}$$

Where δ is the non-stoichiometry, $\Delta_{\%m}$ is the percentage of mass loss, PM_{PVK} is the molecular weight of the perovskite and PM_{O2} is the molecular weight of the Oxygen.

The instrument used for thermogravimetric analysis is the NETZSCH STA Jupiter F1 thermo-heated scale and related Proteus software for data collection and analysis. The head mounts a type P thermocouple with composition 55% Pd / 31% Pt / 14% Au – 65% Au / 35% Pd by weight, works between -150 ° C and 1000 °C and supports alumina crucibles. The mass of the alumina samples and crucibles was determined by measuring on an external balance. The gases used are Argon (Purge 1), Air (Purge 2) and N_2 (protective constant at 20ml / min). Before each analysis, 3 vacuum-Argon cycles are carried out for the conditioning of the environment. In all analyzes the heating rate is 40K / min. All chemicals and gases were purchased and used as received: Nitrogen 6.0, Argon 5.5 (<97%), Air.

DOE-based estimation of stability domain for Ni and Zn-containing perovskites

Training samples definition and model postulation

Defining the stability domain of monophasic perovskite phase, is mandatory to limit the other characterisations, such as perovskite crystal system and oxygen non-stoichiometry, to only monophasic samples. A rational estimation of the stability domain can be conducted by Design of Experiment tools, used both to select a representative set of training samples to be characterised and, in the following sections, to model and optimise the properties of interest. All the calculations are performed using the software CAT [1].

To define training samples, firstly, the entire perovskites' domain, in which each cation is varied from 0 to 1, is homogeneously mapped computing a list of all the possible combinations of the five cations' molar fractions, using a minimum step of 0.1. This list is generally referred to as "candidate point matrix" and in our case includes 1001 possible compositions for La(CrMnFeCoM)O_3, whereas M stands for Ni or Zn, listed in Table S1. Then, a polynomial equation suitable to approximate the actual trend of the properties of interest within the experimental domain is hypothesised. According to preliminary experiments and knowledge, linear terms, 2-cations and 3-cations interactions are included in the polynomial equation leading to the model equation reported in Equation 1.

$$
\begin{aligned}
y
&= b_{Cr}x_{Cr} + b_{Mn}x_{Mn} + b_{Fe}x_{Fe} + b_{Co}x_{Co} + b_{M}x_{M} + b_{CrMn}x_{Cr}x_{Mn} + b_{CrFe}x_{Cr}x_{Fe} + b_{CrCo}\ldots \\
& x_{Mn}x_{Fe} + b_{MnCo}x_{Mn}x_{Co} + b_{MnM}x_{Mn}x_{M} + b_{FeCo}x_{Fe}x_{Co} + b_{FeM}x_{Fe}x_{M} + b_{CoM}x_{Co}x_{M} + b_{Cr}\ldots \\
& + b_{CrMnCo}x_{Cr}x_{Mn}x_{Co} + b_{CrMnM}x_{Cr}x_{Mn}x_{M} + b_{CrFeCo}x_{Cr}x_{Fe}x_{Co} + b_{CrFeM}x_{Cr}x_{Fe}x_{M} + b_{Cr}\ldots \\
& + b_{MnFeCo}x_{Mn}x_{Fe}x_{Co} + b_{MnFeM}x_{Mn}x_{Fe}x_{M} + b_{MnCoM}x_{Mn}x_{Co}x_{M} + b_{FeCoM}x_{Fe}x_{Co}x_{M}
\end{aligned}
$$

Equation 1. General model equation for in the case of La(Cr,Mn,Fe,Co,M)O_3 whereas M stands for Ni or Zn.

Once defined both the candidate point matrix (Table S1) and hypothesised model equation (Equation 1), D-Optimal Design allows to extract the most informative set of training samples (*training set*) from the candidate point lists per each number of experiments to be performed. Analysing the normalized determinant vs. number of samples (Figure S1), the set of 26 training experiments reported in Table S2 is selected as the best compromise between information acquired and experimental effort.[2-3] In Table S2 and in all the following ones, samples labelled as Pn do not include Ni or Zn, PNn samples contain Ni while PZn samples contain Zn.

Each sample described in Table S2 is synthesized according to the procedure in Experimental Conditions and the percentage of perovskite phase, reported in the last column of Table S2, is quantified as described in according by Rietveld refinement of the diffraction pattern for each sample.

Stability domain estimation for Ni-containing perovskites

In the case of La(CrMnFeCoNi)O_3, simply analysing the percentage of perovskite, we can observe that $LaNiO_3$ is the only sample not presenting a perovskite thus the maximum amount of Ni is stepwise reduced till only monophasic materials are obtained. Per each maximum amount tested, the *training set* is expanded by adding further samples with Ni content around the specific limit.

These new samples are calculated applying a specific modification of D-Optimal Design, usually referred to as D-Optimal Design by Addition, [3] that extracts from the updated candidate point list, in our case the list including only samples with Ni equal or below the defined maximum amount in the perovskite (Table S1, seventh and eight columns), the best set of experiments to be added to the already synthesised and characterized *training set* (Table S2). The stepwise expanded *training set* is reported in Table S3 (35 samples).

Zn solubility modelling by Design of Experiments

Differently from the previous case, Zn turns out to be much less soluble than Ni in the perovskite structure since several Zn-containing samples in Table S2 are not monophasic. Therefore, the stepwise estimation is not feasible in this case while Design of Experiments can be applied to model and predict Zn solubility in the perovskite structure or, in other words, the stability domain of monophasic Zn-containing perovskites, according to the general model in Equation 1.

To better evaluate stability domain, the *training set* is expanded by adding further samples with Zn content around 0.5, that seems to be a reasonable upper limit for this cation. These new samples are extracted from the updated candidate point list, containing only compositions with Zn equal or below 0.5 (Table S1, last column) using D-Optimal Design by Addition; the final expanded *training set* is reported in Table S4. The experimental percentage of perovskite phase is then used to calculate the coefficients in Equation 1 by MLR, the coefficients significance is computed relying on standard deviation of fitting residuals and the percentage of perovskite phase is finally predicted in the entire experimental domain to visualise the stability region. Ternary plots have been drawn using Origin(Pro), Version 2018, by OriginLab Corporation, Northampton, MA, USA.The model is finally validated by statistically comparing the experimental percentage of perovskite phase with the predicted one for the samples in the *validation set* (Table S5), composed by the equimolar 5-cations perovskite and the five equimolar 4-cations perovskites obtained excluding one of the cations at the time. The comparison relies on an F-test between Root Mean Square Error in Prediction (RMSEP) and fitting residuals' standard deviation (*s*). [3]

Monophasic training and validation samples synthesis and characterization

Once estimated the stability domain for both Ni and Zn-containing perovskites, the lists of monophasic materials to be characterised is obtained by excluding non-monophasic samples from the expanded *training* *set* in Table S3 and S4. Since the added samples for Zn-containing perovskites (Table S4) also include some materials containing neither Ni nor Zn, namely samples P15-P18, these samples have been included also in *monophasic training set* for Ni-containing perovskites.

Ni-containing monophasic perovskites

As for Ni-containing perovskites, the ultimate list of *monophasic training samples* is reported in Table S10, together with the experimental values for the physico-chemical properties of interest. It must be underlined that the perovskites showing the most interesting properties are synthesised and characterised in replicate to increase the model robustness and estimate the experimental variability associated with the different characterisation procedures.

Table S10: Monophasic training samples for modelling La(Cr,Mn,Fe,Co,Ni)O_3 system (48 experiments including 12 replicates)

Sample	Formula	Cr	Mn	Fe	Co	Ni	Crystal System	δ
P1	$LaCrO_3$	1	0	0	0	0	Orthorhombic	0.003
P2	$La(CrMn)_{0.5}O_3$	0.5	0.5	0	0	0	Orthorhombic	0.006
P3	$La(CrFe)_{0.5}O_3$	0.5	0	0.5	0	0	Orthorhombic	0.002
P4a	$La(CrCo)_{0.5}O_3$	0.5	0	0	0.5	0	Trigonal	0.027
P4b	$La(CrCo)_{0.5}O_3$	0.5	0	0	0.5	0	Trigonal	0.027
P5a	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	Orthorhombic	0.005
P5b	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	Orthorhombic	0.008
P5c	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	Orthorhombic	0.002
P6	$LaMn_{0.4}(CrFe)_{0.3}O_3$	0.3	0.4	0.3	0	0	Orthorhombic	0.011
P7	$LaMn_{0.4}(CrCo)_{0.3}O_3$	0.3	0.4	0	0.3	0	Orthorhombic	0.002
P8	LaMnO3	0	1	0	0	0	Orthorhombic	0.006
P9a	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	Orthorhombic	0.021
P9b	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	Orthorhombic	0.018
P9c	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	Orthorhombic	0.020
P10	$La(MnFe)_{0.5}O_3$	0	0.5	0	0.5	0	Orthorhombic	0.003
P11	$LaMn_{0.4}(FeCo)_{0.3}O_3$	0	0.4	0.3	0.3	0	Orthorhombic	0.003
P12	LaFeO3	0	0	1	0	0	Orthorhombic	0.003
P13	$La(FeCo)_{0.5}O_3$	0	0	0.5	0.5	0	Trigonal	0.021
P14	LaCoO3	0	0	0	1	0	Trigonal	0.003
P15a	$LaMn_{0.6}Co_{0.4}O_3$	0	0.6	0	0.4	0	Orthorhombic	0.024
P15b	$LaMn_{0.6}Co_{0.4}O_3$	0	0.6	0	0.4	0	Orthorhombic	0.017
P16	$LaMn_{0.1}Fe_{0.9}O_3$	0	0.1	0.9	0	0	Orthorhombic	0.009
P17	$LaMn_{0.1}Fe_{0.4}Co_{0.5}O_3$	0	0.1	0.4	0.5	0	Trigonal	0.003
P18	$LaMn_{0.1}Co_{0.9}O_3$	0	0.1	0	0.9	0	Trigonal	0.000
PN1a	$LaMn_{0.4}(CrNi)_{0.3}O_3$	0.3	0.4	0	0	0.3	Orthorhombic	0.003
PN1b	$LaMn_{0.4}(CrNi)_{0.3}O_3$	0.3	0.4	0	0	0.3	Orthorhombic	0.003
PN1c	$LaMn_{0.4}(CrNi)_{0.3}O_3$	0.3	0.4	0	0	0.3	Orthorhombic	0.008

PN2	$LaCo_{0.4}(CrNi)_{0.3}O_3$	0.3	0	0	0.4	0.3	Trigonal	0.002
PN3	$LaCo_{0.4}(MnNi)_{0.3}O_3$	0	0.3	0	0.4	0.3	Trigonal	0.015
PN4	$LaFe_{0.4}(CoNi)_{0.3}O_3$	0	0	0.4	0.3	0.3	Orthorhombic	0.015
PN5	$LaNi_{0.4}(CrFe)_{0.3}O_3$	0.3	0	0.3	0	0.4	Orthorhombic	0.005
PN6	$LaNi_{0.4}(CrCo)_{0.3}O_3$	0.3	0	0	0.3	0.4	Trigonal	0.008
PN7	$LaNi_{0.4}(MnFe)_{0.3}O_3$	0	0.3	0.3	0	0.4	Orthorhombic	0.003
PN8	$La(CrNi)_{0.5}O_3$	0.5	0	0	0	0.5	Orthorhombic	0.002
PN9	$La(MnNi)_{0.5}O_3$	0	0.5	0	0	0.5	Orthorhombic	0.002
PN10	$La(FeNi)_{0.5}O_3$	0	0	0.5	0	0.5	Orthorhombic	0.014
PN11	$La(CoNi)_{0.5}O_3$	0	0	0	0.5	0.5	Trigonal	0.017
PN15	$LaFe_{0.4}Co_{0.1}Ni_{0.5}O_3$	0	0	0.4	0.1	0.5	Trigonal	0.008
PN16	$LaFe_{0.1}Co_{0.4}Ni_{0.5}O_4$	0	0	0.1	0.4	0.5	Trigonal	0.009
PN17a	$La(CrMn)_{0.1}Co_{0.2}Ni_{0.6}O_3$	0.1	0.1	0	0.2	0.6	Trigonal	0.006
PN17b	$La(CrMn)_{0.1}Co_{0.2}Ni_{0.6}O_3$	0.1	0.1	0	0.2	0.6	Trigonal	0.006
PN18a	$LaFe_{0.1}Co_{0.3}Ni_{0.6}O_3$	0	0	0.1	0.3	0.6	Trigonal	0.002
PN18b	$LaFe_{0.1}Co_{0.3}Ni_{0.6}O_3$	0	0	0.1	0.3	0.6	Trigonal	0.003
PN19a	$La(FeCo)_{0.2}Ni_{0.6}O_3$	0	0	0.2	0.2	0.6	Trigonal	0.000
PN19b	$La(FeCo)_{0.2}Ni_{0.6}O_3$	0	0	0.2	0.2	0.6	Trigonal	0.003
PN20	$LaMn_{0.2}Co_{0.1}Ni_{0.7}O_3$	0	0.2	0	0.1	0.7	Trigonal	0.008
PN21a	$LaCr_{0.2}Ni_{0.8}O_3$	0.2	0	0	0	0.8	Trigonal	0.001
PN21b	$LaCr_{0.2}Ni_{0.8}O_3$	0.2	0	0	0	0.8	Trigonal	0.001

Table S11 reports the compositions and the characterisations' results for samples included in the *validation set:* this set is arbitrarily computed in order to include the equimolar 5-cations perovskite and the five equimolar 4-cations perovskites obtained excluding one of the cations at the time, as already hinted above.

Table S11. Validation samples for modelling $La(Cr,Mn,Fe,Co,Ni)O_3$ system (6 experiments)

Sample	Formula	Cr	Mn	Fe	Co	Ni	Crystal Sytem	δ
P19	$La(CrMnFeCo)_{0.25}O_3$	0.25	0.25	0.25	0.25	0	Orthorhombic	0.002
PN22	$La(CrMnFeCoNi)_{0.2}O_3$	0.2	0.2	0.2	0.2	0.2	Orthorhombic	0.002
PN23	$La(CrMnFeNi)_{0.25}O_3$	0.25	0.25	0.25	0	0.25	Orthorhombic	0.002
PN24	$La(CrMnCoNi)_{0.25}O_3$	0.25	0.25	0	0.25	0.25	Trigonal	0.005
PN24	$La(CrMnCoNi)_{0.25}O_3$	0.25	0.25	0	0.25	0.25	Trigonal	0.003
PN25	$La(CrFeCoNi)_{0.25}O_3$	0.25	0	0.25	0.25	0.25	Orthorhombic	0.008
PN26	$La(MnFeCoNi)_{0.25}O_3$	0	0.25	0.25	0.25	0.25	Orthorhombic	0.017

Zn-containing monophasic perovskites

Moving to Zn-containing perovskites, the ultimate list of *monophasic training samples* is reported in Table S12, together with the experimental values for the physico-chemical properties of interest. It must be underlined that, also in this case, the most interesting samples are synthesised and characterised in replicate.

Table S12. Monophasic training samples for modelling La(Cr,Mn,Fe,Co,Zn)O_3 system (41 experiments including 12 replicates)

Sample	Formula	Cr	Mn	Fe	Co	Zn	Crystal Sytem	δ
P1	$LaCrO_3$	1	0	0	0	0	Orthorhombic	0.003
P2	$La(CrMn)_{0.5}O_3$	0.5	0.5	0	0	0	Orthorhombic	0.006
P3	$La(CrFe)_{0.5}O_3$	0.5	0	0.5	0	0	Orthorhombic	0.002
P4a	$La(CrCo)_{0.5}O_3$	0.5	0	0	0.5	0	Trigonal	0.027
P4b	$La(CrCo)_{0.5}O_3$	0.5	0	0	0.5	0	Trigonal	0.027
P5a	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	Orthorhombic	0.005
P5b	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	Orthorhombic	0.008
P5c	$LaCr_{0.4}(FeCo)_{0.3}O_3$	0.4	0	0.3	0.3	0	Orthorhombic	0.002
P6	$LaMn_{0.4}(CrFe)_{0.3}O_3$	0.3	0.4	0.3	0	0	Orthorhombic	0.011
P7	$LaMn_{0.4}(CrCo)_{0.3}O_3$	0.3	0.4	0	0.3	0	Orthorhombic	0.002
P8	LaMnO3	0	1	0	0	0	Orthorhombic	0.006
P9a	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	Orthorhombic	0.021
P9b	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	Orthorhombic	0.018
P9c	$La(MnFe)_{0.5}O_3$	0	0.5	0.5	0	0	Orthorhombic	0.020
P10	$La(MnFe)_{0.5}O_3$	0	0.5	0	0.5	0	Orthorhombic	0.003
P11	$LaMn_{0.4}(FeCo)_{0.3}O_3$	0	0.4	0.3	0.3	0	Orthorhombic	0.003
P12	LaFeO3	0	0	1	0	0	Orthorhombic	0.003
P13	$La(FeCo)_{0.5}O_3$	0	0	0.5	0.5	0	Trigonal	0.021
P14	LaCoO3	0	0	0	1	0	Trigonal	0.003
P15a	$LaMn_{0.6}Co_{0.4}O_3$	0	0.6	0	0.4	0	Orthorhombic	0.024
P15b	$LaMn_{0.6}Co_{0.4}O_3$	0	0.6	0	0.4	0	Orthorhombic	0.017
P16	$LaMn_{0.1}Fe_{0.9}O_3$	0	0.1	0.9	0	0	Orthorhombic	0.009
P17	$LaMn_{0.1}Fe_{0.4}Co_{0.5}O_3$	0	0.1	0.4	0.5	0	Trigonal	0.003
P18	$LaMn_{0.1}Co_{0.9}O_3$	0	0.1	0	0.9	0	Trigonal	0.000
PZ13	$LaCr_{0.3}Mn_{0.5}Zn_{0.2}O_3$	0.3	0.5	0	0	0.2	Orthorhombic	0.017
PZ14	$LaCr_{0.3}Fe_{0.4}Co_{0.1}Zn_{0.2}O_3$	0.3	0	0.4	0.1	0.2	Orthorhombic	0.012
PZ15	$LaMn_{0.7}Fe_{0.1}Zn_{0.2}O_3$	0	0.7	0.1	0	0.2	Orthorhombic	0.006
PZ16a	$LaCr_{0.7}Zn_{0.3}O_3$	0.7	0	0	0	0.3	Orthorhombic	0.041
PZ16b	$LaCr_{0.7}Zn_{0.3}O_3$	0.7	0	0	0	0.3	Orthorhombic	0.035
PZ17a	$LaCr_{0.4}(FeZn)_{0.3}O_3$	0.4	0	0.3	0	0.3	Orthorhombic	0.070
PZ17b	$LaCr_{0.4}(FeZn)_{0.3}O_3$	0.4	0	0.3	0	0.3	Orthorhombic	0.056
PZ1	$LaMn_{0.4}(CrZn)_{0.3}O_3$	0.3	0.4	0	0	0.3	Orthorhombic	0.011

PZ18	$La(CrMn)_{0.3}Fe_{0.1}Zn_{0.3}O_3$	0.3	0.3	0.1	0	0.3	Orthorhombic	0.012
PZ21a	$LaMn_{0.4}(CoZn)_{0.3}O_3$	0	0.4	0	0.3	0.3	Orthorhombic	0.060
PZ21b	$LaMn_{0.4}(CoZn)_{0.3}O_3$	0	0.4	0	0.3	0.3	Orthorhombic	0.065
PZ24	$LaCr_{0.3}Mn_{0.2}Co_{0.1}Zn_{0.3}O_3$	0.3	0.2	0	0.1	0.4	Orthorhombic	0.008
PZ25a	$LaMn_{0.5}Co_{0.1}Zn_{0.4}O_3$	0	0.5	0	0.1	0.4	Orthorhombic	0.023
PZ25b	$LaMn_{0.5}Co_{0.1}Zn_{0.4}O_3$	0	0.5	0	0.1	0.4	Orthorhombic	0.020
PZ25c	$LaMn_{0.5}Co_{0.1}Zn_{0.4}O_3$	0	0.5	0	0.1	0.4	Orthorhombic	0.021
PZ9	$La(MnZn)_{0.5}O_3$	0	0.5	0	0	0.5	Orthorhombic	0.012

The same approach already discussed in the case of Ni is followed to compute the *validation set* for Zn-containing perovskites, reported in Table S5.

Table S13. Validation samples for modelling $La(Cr,Mn,Fe,Co,Zn)O_3$ system (6 experiments)

Sample	Formula	Cr	Mn	Fe	Co	Zn	Crystal Sytem	δ
P19	$La(CrMnFeCo)_{0.25}O_3$	0.25	0.25	0.25	0.25	0	Orthorhombic	0.002
PZ26	$La(CrMnFeCoZn)_{0.2}O_3$	0.2	0.2	0.2	0.2	0.2	Orthorhombic	0.008
PZ27	$La(CrMnFeZn)_{0.25}O_3$	0.25	0.25	0.25	0	0.25	Orthorhombic	0.015
PZ28	$La(CrMnCoZn)_{0.25}O_3$	0.25	0.25	0	0.25	0.25	Orthorhombic	0.029
PZ29	$La(CrFeCoZn)_{0.25}O_3$	0.25	0	0.25	0.25	0.25	Orthorhombic	0.063
PZ30	$La(MnFeCoZn)_{0.25}O_3$	0	0.25	0.25	0.25	0.25	Orthorhombic	0.002

Perovskites crystal system modelling and prediction by Design of Experiments

Design of Experiments is applied to model and predict the crystal system of the perovskites under investigation as it glaringly appears looking at the crystal system of samples in Table S12, determined by Rietveld method, monophasic Zn-containing perovskites exhibit only orthorhombic crystal system thus this property will be investigated only for Ni-containing materials.

Monophasic training samples in Table 12 are used to model the perovskite's crystal system, reported in the eighth column and determined by Rietveld method, according to the polynomial equation reported in Equation 1. From a mathematical point of view, perovskite crystal system is a dichotomic response, since only orthorhombic or trigonal materials have been obtained, thus we codify this dichotomic response into a 0-1 scale (1 for orthorhombic and 0 for trigonal) for the *monophasic training samples* to build the mathematical model and compute the coefficients by Multiple Linear Regression (MLR). [4]

The so-calculated coefficients are then used to predict the crystal system in the entire stability range assigning orthorhombic crystal system to predicted values above 0.55, trigonal crystal system for predictions below 0.45 and leaving a non-assigned region for intermediate predicted values between 0.45 and 0.55.

Being the crystal system a qualitative feature, the validation is performed by directly comparing the experimental and predicted crystal system for the samples in the *validation set* in Table S11 since no RMSE can be actually computed on such a response.

Oxygen non-stoichiometry modelling and optimisation by Design of Experiments

Finally, *monophasic training samples* are then employed to model and optimise the oxygen non-stoichiometry, reported in the last column, both in the case of Ni (Table S10) and Zn-containing (Table S12) perovskites, according to the polynomial model reported in Equation 1.

The experimental values determined for the *monophasic training samples* according to the procedure in Experimental Conditions are used to calculate the coefficients by Multiple Linear Regression; the coefficients' significance is addressed according to the standard deviation of fitting residuals. Finally, the calculated coefficients are used to estimate the oxygen non-stoichiometry crystal system in the entire stability range for both the cases.

Finally, model validation is performed statistically comparing the Root Mean Square Error in Prediction (RMSEP) for the *validation samples* in Table S11 (Ni-containing perovskites) and Table S5 (Zn-containing perovskites) with the fitting residuals standard deviation using an F-test. [3]

References

[1] R. Leardi, C. Melzi, G. Polotti, CAT (Chemometric Agile Tool), freely downloadable from http://gruppochemiometria.it/index.php/software

[2] D. Copelli, A. Falchi, M. Ghiselli, E. Lutero, R. Osello, D. Riolo, F. Schiaretti, R. Leardi. Sequential "asymmetric" D-optimal designs: a practical solution in case of limited resources and not equally expensive experiments. Chemom. Intell. Lab. Sys. 178 (2018) 24–31. https://doi.org/10.1016/j.chemolab.2018.04.017

[3] L. R. Magnaghi, M. Guembe-Garcia, V. Cerone, P. Perugini, G. Albert, R. Biesuz. DOE-based multi-criteria optimization of starch/gly/CMC films' composition and preparation procedure by casting deposition. Chemom. Intell. Lab. Sys. 244 (2024) 105044.

[4] R. Leardi. Experimental design in chemistry: A tutorial. Anal. Chim. Acta. 652 (2009) 161–172. https://doi.org/10.1016/j.aca.2009.06.015