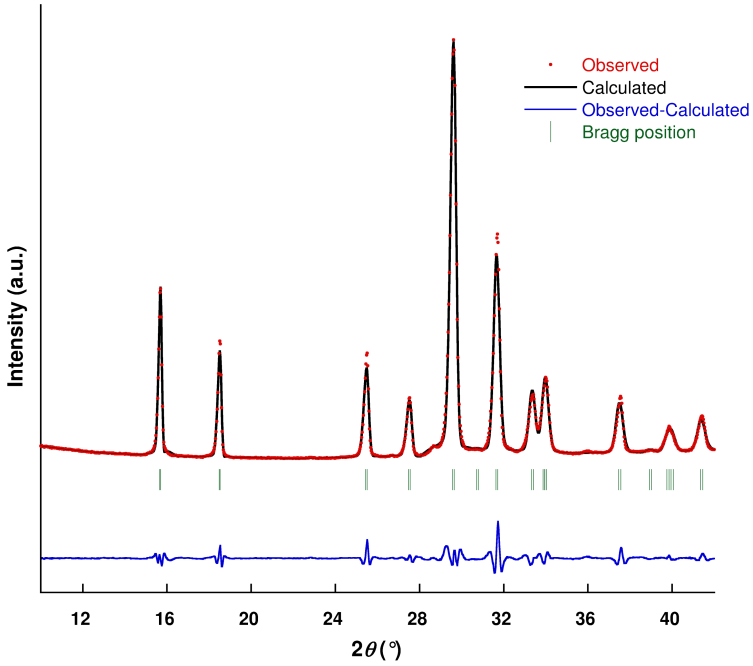

Figure S1. Rieveld refinement of $Li_2C_4O_4$ from experimental pattern obtained at 150 K.

$Li_2C_4O_4$				
Space group C2/m χ^2= 23.0 R_{Bragg}= 1.64 % R_p = 10.1 % R_{wp} = 11.7 %				
a= 7.1231(7) Å *b*= 9.5945(10) Å *c*= 3.3023(2) Å *β*= 100.86(1)° *V*= 221.65(3)Å^3				
Atom	*Wyckoff site*	*x*	*y*	*z*
Li	4*h*	0	0.345(2)	0.5
C1	4*i*	0.1396(14)	0	0.145(5)
C2	4*g*	0	0.1107(8)	0
O1	4*i*	0.3137(12)	0	0.380(4)
O2	4*g*	0	0.2423(10)	0

Table S1. Crystallographic data and atomic positions of $Li_2C_4O_4$ (T = 150 K). Results from the Rietveld refinement against X-Ray diffraction ((λ_{Cu1}=1.54056 Å and λ_{Cu2}=1.54439 Å) at 150 K.