Electronic Supplementary Information

Post-transition metal/polymer composites for the separation and sensing of alkali metal ions

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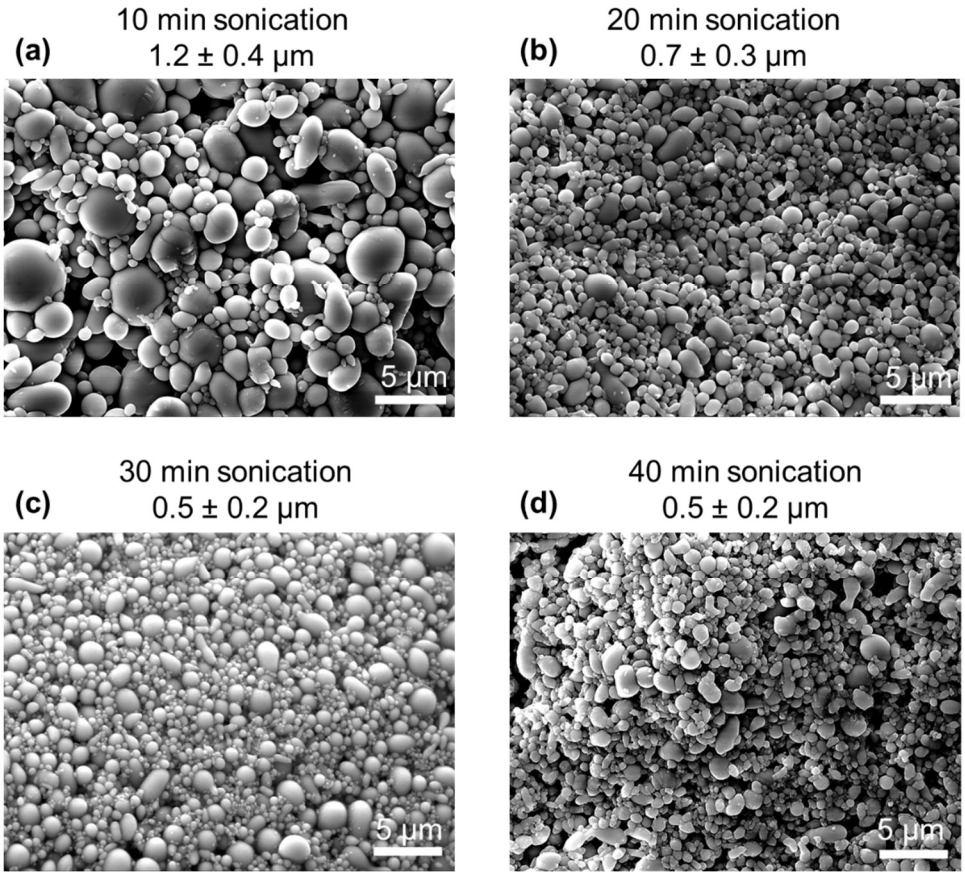

Fig. S1 SEM images and average size distribution of the EGaIn particles synthetized after (a): 10 min, (b): 20 min, (c): 30 min and (d): 40 min of sonication time.

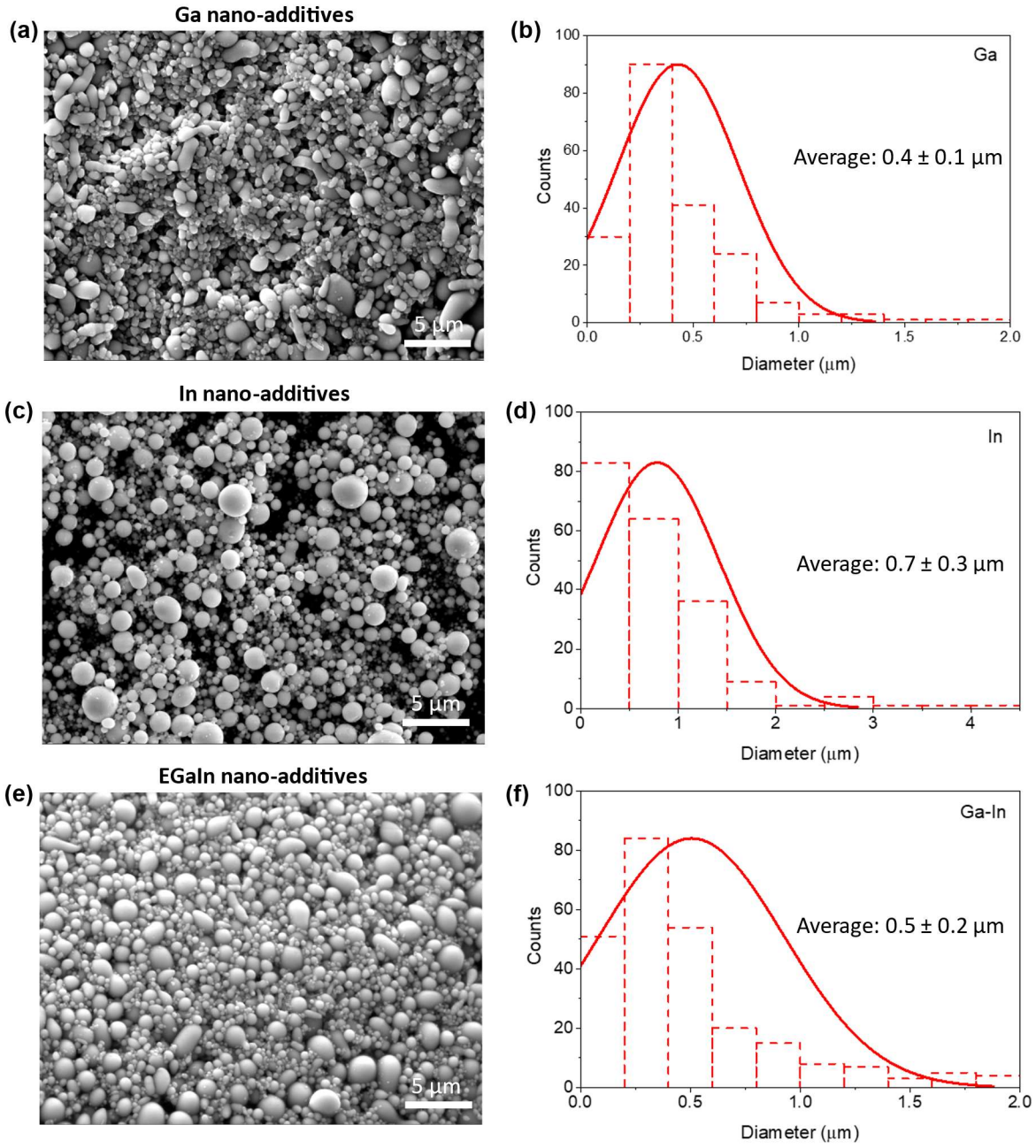

Fig. S2 (a) SEM image of the Ga nano-additives and (b) respective size distribution. (c) SEM image of the In nano-additives and (d) respective size distribution. (e) SEM image of the EGaIn nano-additives and (f) respective size distribution.

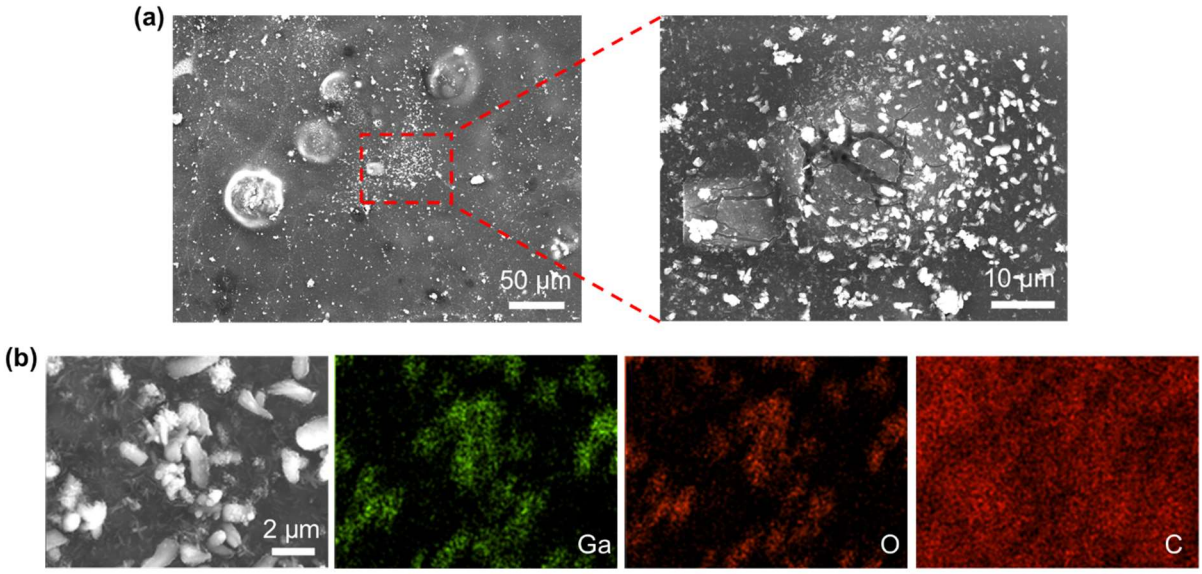

Fig. S3 (a) SEM images of the surface of the Ga composite. (b) SEM-EDS mapping of the surface of the Ga composite.

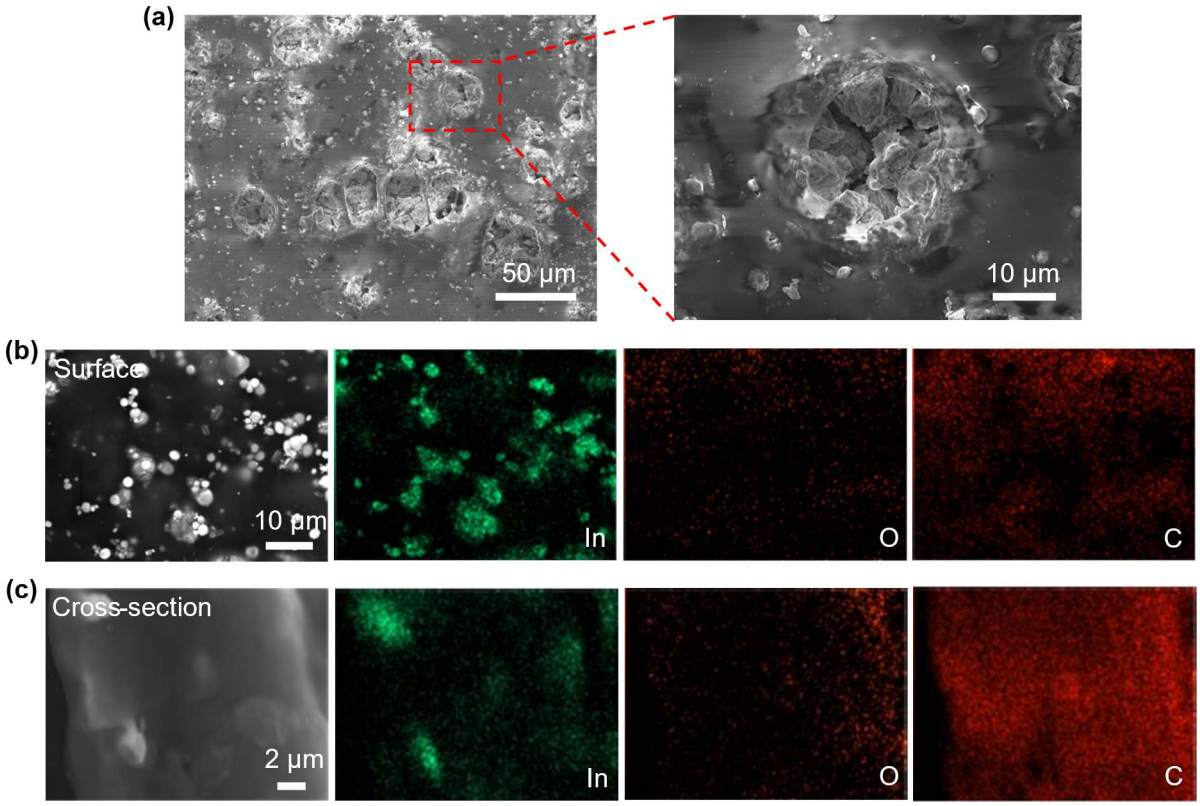

Fig. S4 (a) SEM images of the surface of the In-composite. (b) SEM-EDS mapping of the surface of the In composite and (c) SEM-EDS mapping of the cross-section of the In composite.

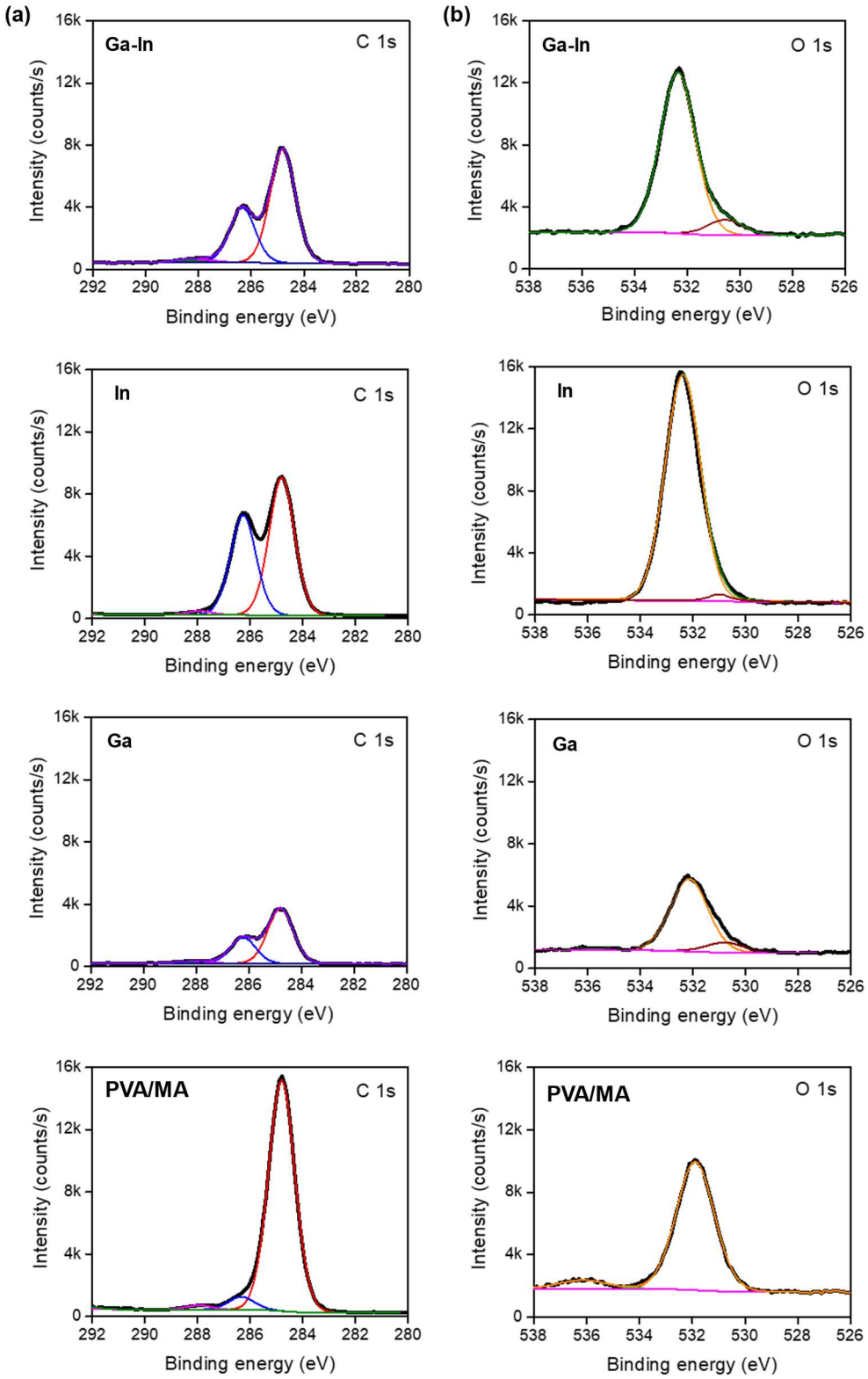

Fig. S5 (a) Deconvoluted high resolution C 1s and (b) O 1s XPS peaks of the Ga-In, In, Ga composites, and the plain PVA/MA film as indicated.

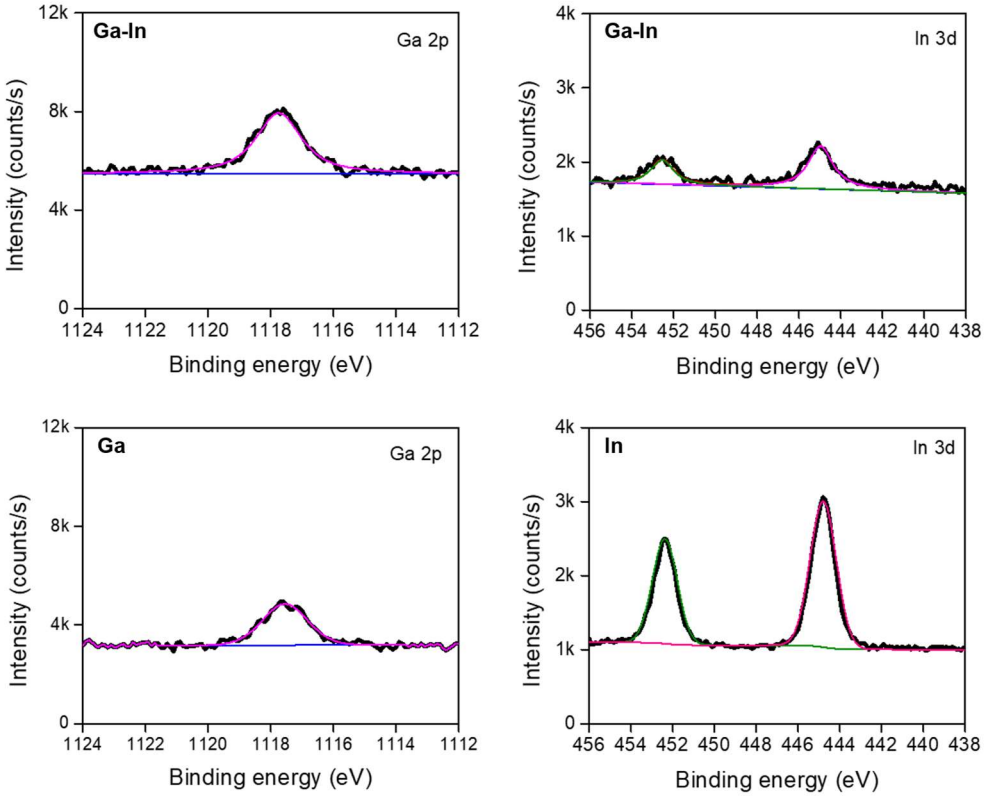

Fig. S6 Deconvoluted high resolution Ga 2p and In 3d XPS peaks of the Ga-In, In, Ga composites as indicated.

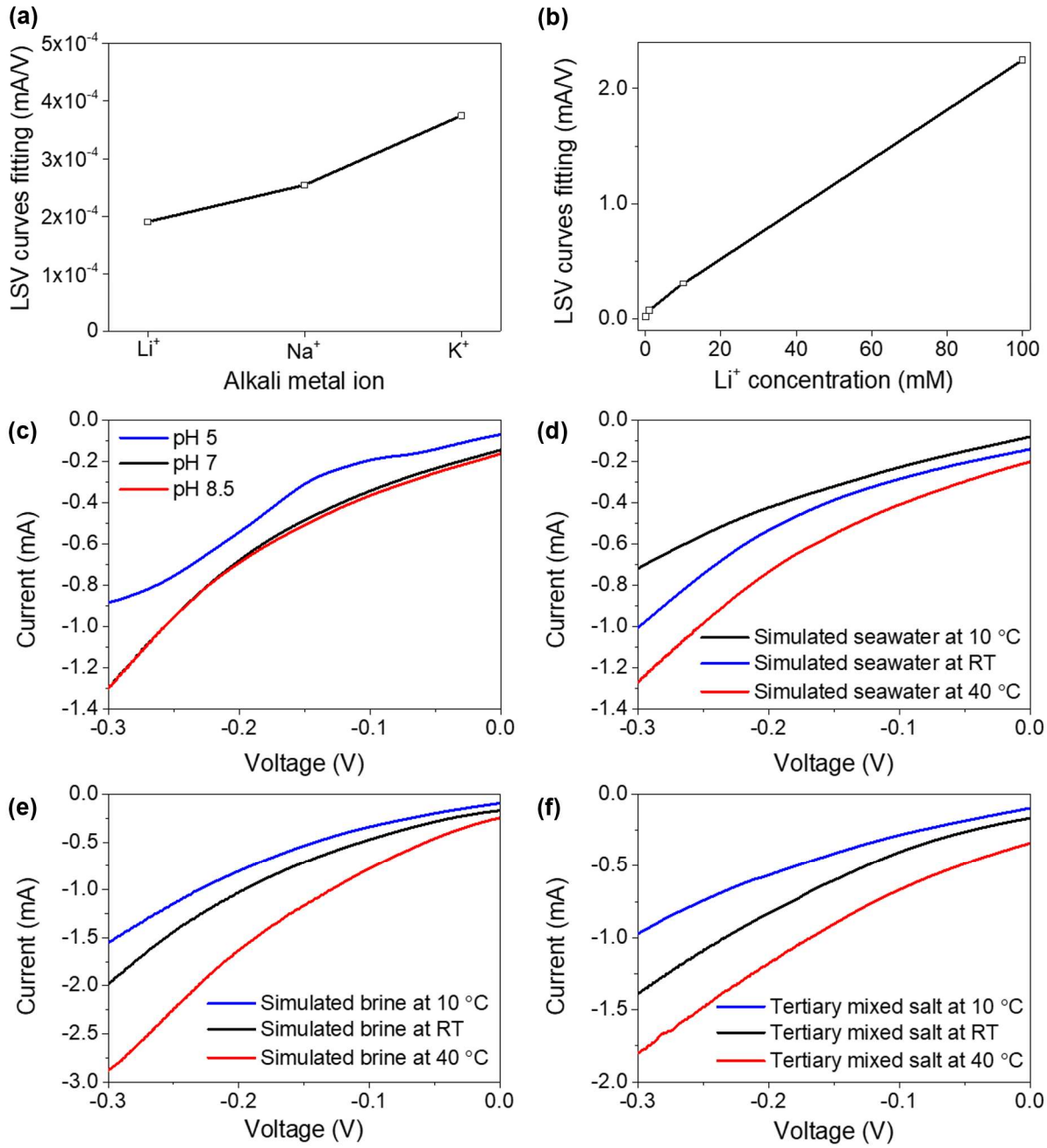

Fig. S7 (a) Fitting of the linear region of the LSV curves for Li^+, Na^+ and K^+ at a concentration of 0.1 M. (b) Fitting of the linear region of the LSV curves for different concentration of Li^+: 0.00, 0.05 mM, 1 mM, 10 mM and 100 mM. (c) LSV curves of the Ga-In composite in the tertiary mixtures at pH ranging from 5 to 8.5. (d), (e) and (f) LSV curves of the Ga-In composite in the simulated seawater, brine and tertiary salt mixture, respectively, at temperatures ranging from 10 °C to 40 °C.

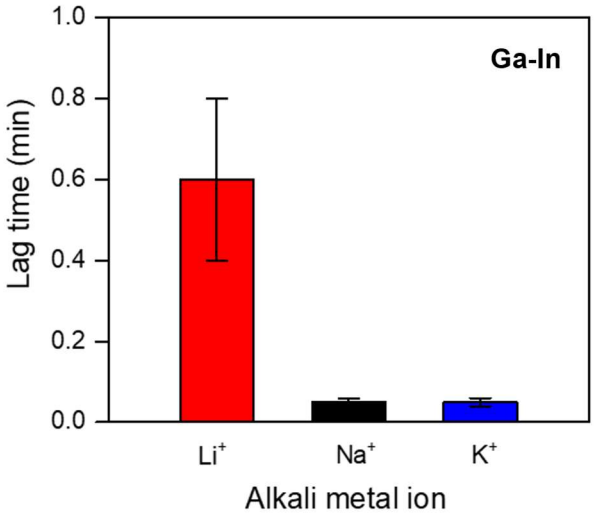

Fig. S8 Measured lag time across the Ga-In composite for single Li^+, Na^+ and K^+ electrolytes.

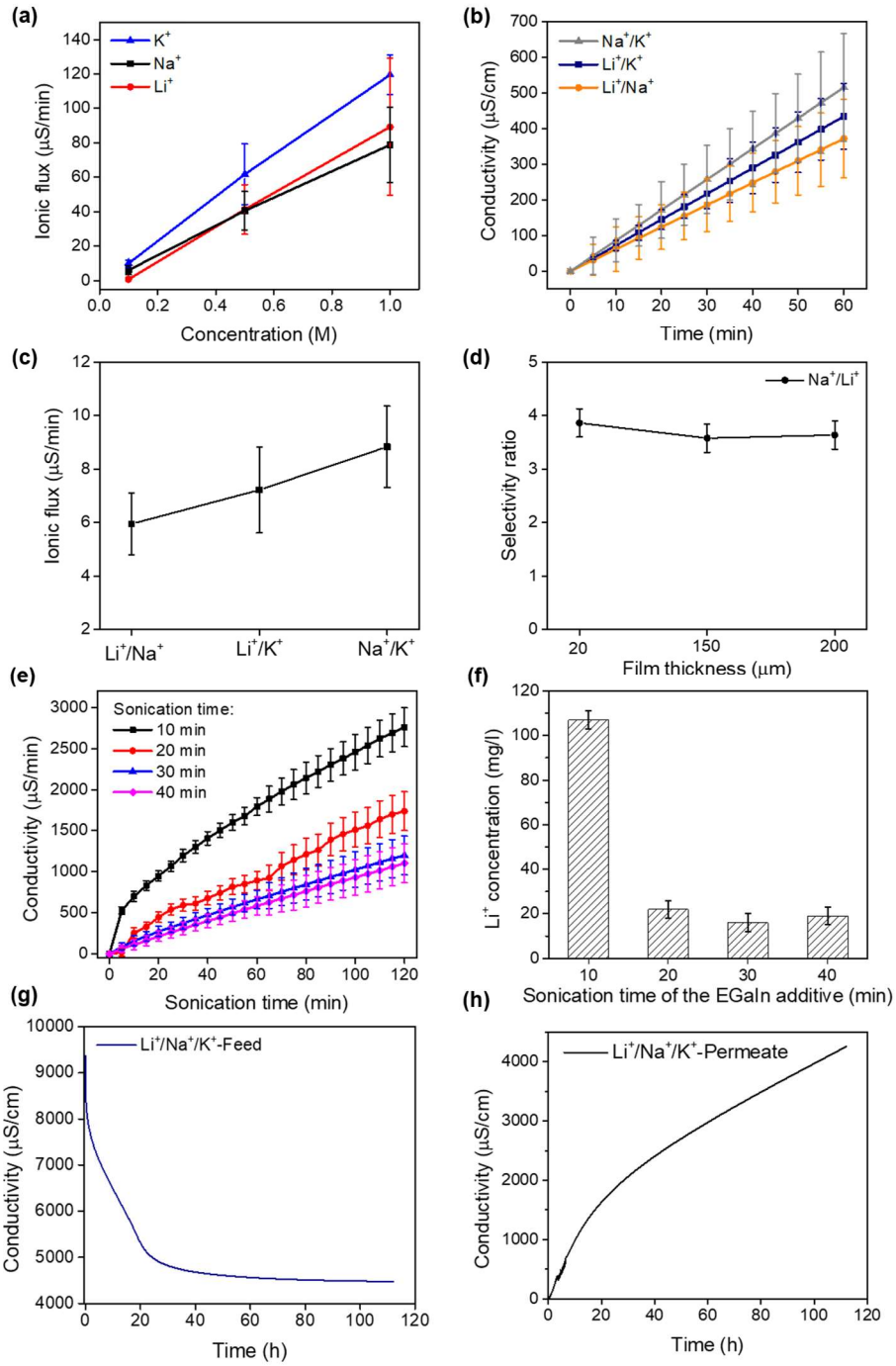

Fig. S9 (a) Ionic fluxes as a function of the feed concentration for the Ga-In composite for Li^+, Na^+ and K^+ electrolytes. (b) Ionic conductivity as a function of the diffusion time for the Ga-In composite in mixed Na^+/K^+, Li^+/K^+ and Li^+/Na^+ electrolytes, and (c) respective calculated ionic fluxes. (d) Calculated Na^+/Li^+ selectivity ratios as a function of the thickness of the Ga-In composites. (e) Ionic conductivity as a function of the diffusion time for Ga-In composites prepared with EGaIn nano-additives of different average sizes as a function of the sonication time, in mixed Li^+/Na^+ electrolytes. (f) Li^+ concentration in the permeate after 2 hrs of diffusion experiment as determined by ICP-OES. (g) Ionic conductivity as a function of the diffusion time in the feed and (h) in the permeate.

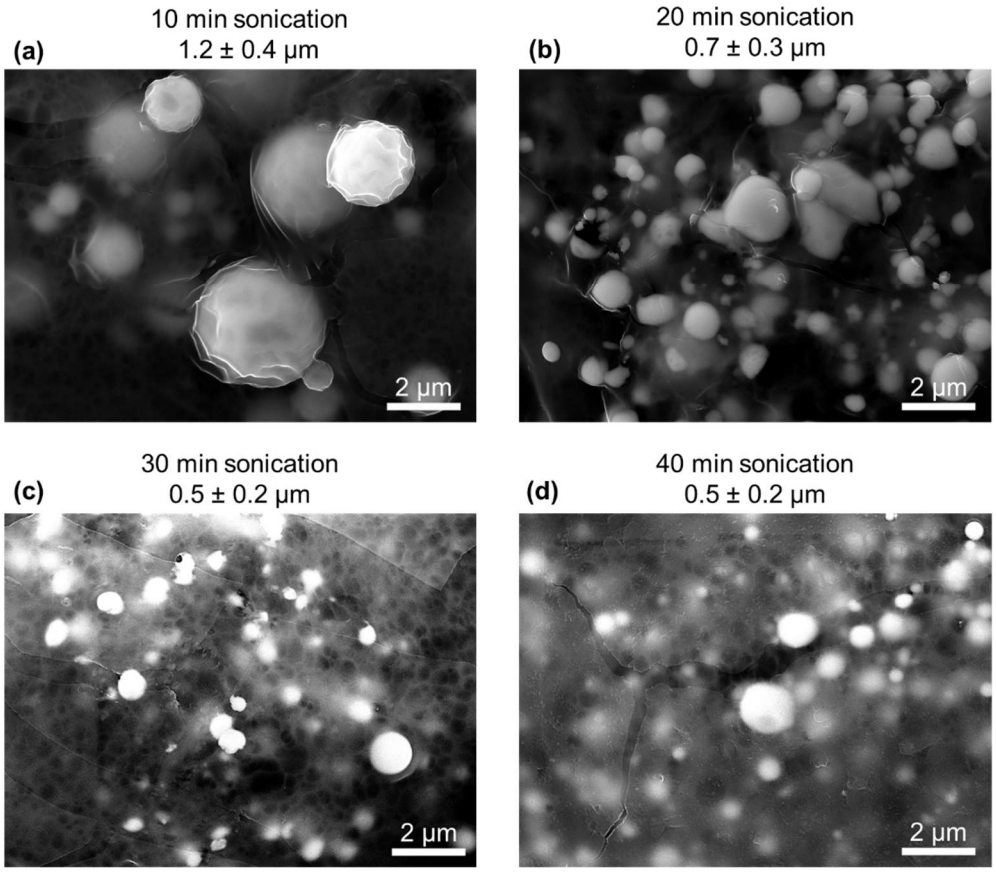

Fig S10 SEM images of the surface of the Ga-In composites prepared with EGaIn nano-additives synthesized with (a): 10 min sonication time, (b) 20 min sonication time, (c) 30 min sonication time and (d) 40 min sonication time.

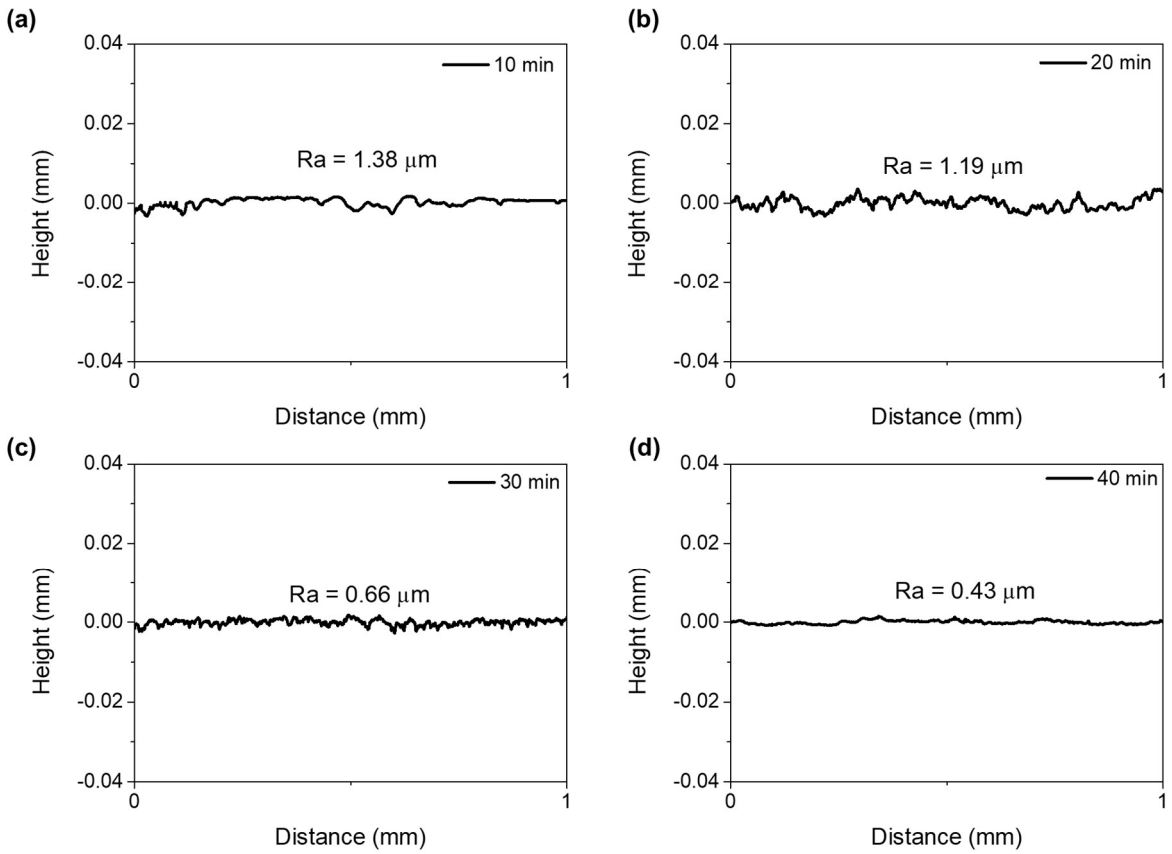

Fig S11 Profilometer measurements and average calculated roughness (Ra) of the Ga-In composites containing the EGaIn additives prepared with (a) 10 min, (b) 20 min, (c) 30 min, and (d) 40 min sonication time.

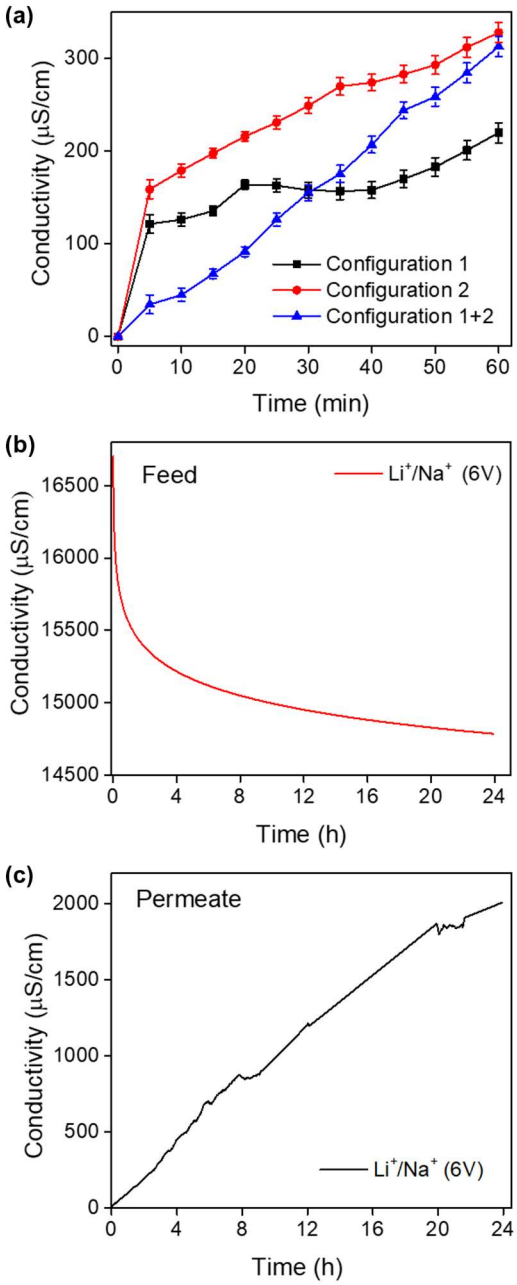

Fig. S12 (a) Ionic conductivity as a function of the three different electrode configurations for the Ga-In composite in Li^+ electrolyte. (b) Ionic conductivity as a function of the electro-diffusion time for the Ga-In composite in mixed Li^+/Na^+ electrolyte in the feed compartment and (c) the permeate compartment at fixed voltage (6 V).

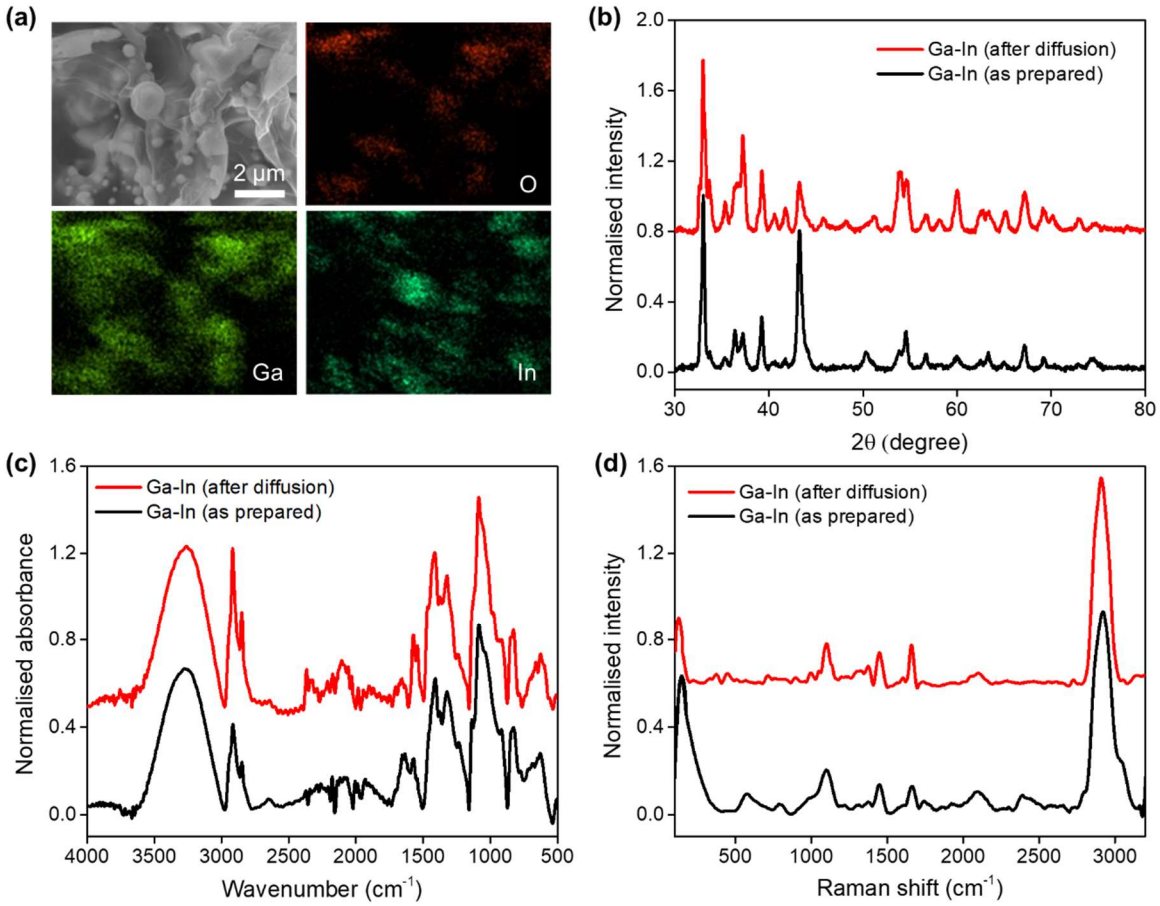

Fig. S13 (a) SEM-EDS mapping of the cross-section of the Ga-In composite after diffusion experiments (110 hrs). Comparison of (b) XRD patterns, (c) and (d) FTIR and Raman spectra of the Ga-In composite before and after diffusion experiments (110 hrs).

Table S1. Composition of the simulated continental brine and seawater solutions.

Lithium-rich source	**Na^+**	**K^+**	**Li^+**
Continental brine	0.46 M	0.04 M	0.001 M
Seawater	0.18 M	0.005 M	0.002 mM