

## Saloplastics as multiresponsive ion exchange reservoirs and catalyst supports

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### ABSTRACT

Developing saloplastics composed of Compacted Polyelectrolyte Complexes (COPECs) represents a promising strategy for assembling multifunctional and processable polymer matrices in a simple manner. Here, a comprehensive investigation of the potential application of saloplastics as ion reactors for designing catalysts has been performed. First the propensity of saloplastics to exchange and concentrate ions has been elucidated through investigating the influence of Na<sup>+</sup> to Cu<sup>2+</sup> cation exchange within COPECs assembled from poly(methacrylic acid) (PMAA) and poly(allylamine hydrochloride) (PAH). The multi-scale responses of PMAA/PAH COPECs upon incubation with CuCl<sub>2</sub> solutions at pH 3 and 4.5 were investigated chemically by ATR-FTIR, ICP, XPS, DSC and TGA, morphologically by SEM, and mechanically by strain-to-break measurements. Both the amplitude and the kinetics of the COPEC response were driven by the deprotonation rate of PMAA chains, enabling the formation of bridge complexes with Cu<sup>2+</sup> and impacting the saloplastic's composition (water content and polyelectrolytes), structure (emergence of macropores) and mechanical properties. Kinetic-based tuning of the molality of copper ions trapped in PMAA/PAH COPECs was demonstrated, enabling the usage of saloplastics as reactors. This ability allowed controlling the growth of Cu(0) nanoparticles in saloplastics by thermal annealing, ultimately adjusting their catalytic activity toward carbon monoxide (CO) oxidation. This work highlights how the ionic reservoir properties of saloplastics must be accounted for when designing the applications of COPEC-based materials.

### KEYWORDS

Cation exchanges; Multi-responsive; Poly(allylamine hydrochloride); Poly(methacrylic acid); Polyelectrolyte complexes; Polymer matrices; Reservoir property; Thermal-annealing

## **ACKNOWLEDGMENTS**

This work was supported by the International Center for Young Scientists (ICYS), the Japanese Society for the Promotion of Science (JSPS) and the JSPS KAKENHI (Grant No. JP18F18797). F. S. thanks the JSPS for his postdoctoral Fellowship. G. R. thanks the Material Analysis Station from NIMS for ICP and XPS measurements as well as Dr Boulmedais and Mr Hauru for fruitful discussions. A. P. acknowledges Science Foundation Ireland (SFI) for his SIRG grant.