Metal-Doped Biopolymer-Based Aerogels for Catalytic Applications

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Aerogels have properties that render them good candidates for use in catalysis (high porosity, high specific surface area, thermal stability),[1] with the aerogels acting either as catalysts themselves or as chemically inert hosts of finely dispersed catalytic nanoparticles. However, the use of inorganic oxide aerogels in catalysis is hindered by their fragility.[2] This problem has been resolved by the polymer-crosslinking technology, which employs dangling –OH groups as a chemical template for the formation of a nano-thin conformal polymer coating over the entire skeletal framework.[3] This technology has recently been applied to biopolymer aerogels, which are cost-effective and environmentally friendly materials, but also mechanically-weak, resulting to polyurethane/polyurea-crosslinked alginate aerogels that can be as stiff as organic aerogels having two or three times their density.[4]

Herein we present the synthesis and characterization of polymer-crosslinked alginate aerogels, bearing various metal ions. Those materials have been characterized in terms of their chemical structure, and porous network. Their high carbonization yields make them very promising precursors for metal-doped carbon aerogels,[5] with applications in catalysis.

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References

(1) Kistler, S. S.; Swann, S.; Appel, E. G. Aerogel Catalysts - Thoria: Preparation of Catalyst and Conversions of Organic Acids to Ketones. *Ind. Eng. Chem.* **1934**, *26* (4), 388–391.

(2) Pierre, A. C.; Pajonk, G. M. Chemistry of Aerogels and Their Applications. *Chemical Reviews* **2002**, *102* (11), 4243–4266.

(3) Leventis, N. Three-Dimensional Core-Shell Superstructures: Mechanically Strong Aerogels. *Accounts of Chemical Research* **2007**, *40* (9), 874–884.

(4) Paraskevopoulou, P.; Smirnova, I.; Athamneh, T.; Papastergiou, M.; Chriti, D.; Mali, G.; Čendak, T.; Chatzichristidi, M.; Raptopoulos, G.; Gurikov, P. Mechanically Strong Polyurea/Polyurethane-Cross-Linked Alginate Aerogels. *ACS Appl. Polym. Mater.* **2020**, *2* (5), 1974–1988.

(5) Paraskevopoulou, P.; Gurikov, P.; Raptopoulos, G.; Chriti, D.; Papastergiou, M.; Kypritidou, Z.; Skounakis, V.; Argyraki, A. Strategies toward Catalytic Biopolymers: Incorporation of Tungsten in Alginate Aerogels. *Polyhedron* **2018**, *154*, 209–216.