Highly ordered honeycomb polystyrene patterns decorated with polyoxometalates for catalytic applications

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Breath figure process is a cost-effective method for preparing highly ordered honeycomb patterns from polymer solutions. In this process, a polymer solution is casted onto a substrate under adequate humidity and the evaporation of the solvent cools down the solvent/air interface inducing the condensation of small water droplets.[1] The variation of the concentration, solvent and relative humidity enables the control over the formation of honeycomb patterns.[2] The fabrication of honeycomb arrays has received an increasing interest due to the potential applications of these structures in different areas, such as tissue-engineering, membranes, or catalysis.[3] In our study, honeycomb patterns have been obtained from polystyrene/poly(polystyrene-*b*-polyacrylic acid) blends. The resulting porous arrays have been decorated with polyoxometalates in order to obtain polymer films with maximized catalytic capability.
Polyoxometalates are anionic transition metal-oxo clusters of nanometric size that can act as both strong Brønsted acids and oxidation catalysts showing fast and reversible multistep redox processes without significant structural changes. The decavanadate-based $[Cu(cyclam)][\{Cu(cyclam)\}_2(V_{10}O_{28})]\cdot 10H_2O$ microporous hybrid (cyclam = 1,4,8,11-tetraazacyclotetradecane) has been recently employed as catalyst for the oxidation of the highly stable, tricyclic alkane adamantane.[4] A scheme of the functional polymeric surface decorated with the Cu(cyclam)-decavanadate hybrid is shown in Figure 1.

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Figures

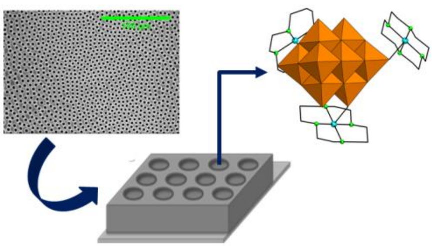

Figure 1: Poly(styrene)/Poly(styrene-*b*-acrylic acid) blend breath figures decorated with $\{Cu(cyclam)\}^{2+}$ and $(V_{10}O_{28})^{6-}$·units.