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**Design of Functional Multicomponent Nanoporous Metal Oxides and Their Heterostructures Using Polymer Templates**

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**Tuesday, 9/4, 13:30, 3rd floor meeting room**

Robust and efficient process for synthesis of various composition inorganic coatings with controlled nanoporosity and structure is highly desirable for design of efficient catalytic, purification, and detection systems. Recently, infiltration of a nanoporous polymer template with inorganic precursors using sequential infiltration synthesis with inorganic vapor precursors followed by oxidative annealing was proposed as a new and efficient approach to create porous inorganic structures with tunable porosity and composition. The major limitations of the original water-based thermal sequential infiltration synthesis, though, are the thickness of the patterned structure being limited by vapor penetration depth of the precursors into the polymer template and the resulting material selection being restricted by the availability of high vapor pressure precursors. Here, we propose a swelling-based modification to the polymer infiltration process that allows to overcome these limitations. We summarize the basics of the multi-step infiltration approach, the structure and properties of the resulting materials, and their functional potential for practical applications. We report ultra-high accessibility of the pores when porous films are prepared via the polymer swelling-based infiltration synthesis (SBI). Using a quartz crystal microbalance (QCM) technique, we demonstrate increased solvent absorbing capabilities of highly porous ceramic films as a result of high interconnectivity of the pores in such structures. Our results show that the approach can be been extended toward preparing conformal coatings, freestanding membranes, and powders consisting of metal or metal oxide nanoparticles embedded in a porous oxide matrix.