A2-07 Tackling Big Challenges Using Tiny Crystals

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Catalytic processes are central to the goal of a sustainable future. A promising approach in developing catalytic materials is represented by the design of catalytic sites based on the knowledge of structure-property relationships, and in the precise synthesis of these sites at the atomic level. Colloidal nanocrystals, with tunable active sites and compositions, can help in this mission.[1] The goal of this talk is to show how this approach can provide not only fundamental understanding of catalytic reactions, but also a way to precisely engineer reaction sites to produce efficient catalysts that are active, stable and selective for several important transformations. Advances in the synthesis of these materials will be presented.[2] Examples of the use of these building blocks as supported systems or in combination with hybrid organic materials will be shown, both to understand trends in methane and CO_2 activation, and in the preparation of optimized catalytic systems combining multiple active phases.[3,4,5] In all these examples, important efforts to obtain precious structure-property relationships will be highlighted, with this knowledge used to prepare more efficient and stable catalysts for reducing the emission of greenhouse gases and for the sustainable production of fuels and chemicals.

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PROFILE

Matteo Cargnello (Department of Chemical Engineering, Stanford University)

Matteo Cargnello received his Ph.D. in Nanotechnology in 2012 at the University of Trieste, Italy, under the supervision of Prof. Paolo Fornasiero, and he was then a post-doctoral scholar in the Chemistry Department at the University of Pennsylvania with Prof. Christopher B. Murray before joining the Faculty at Stanford University in January 2015. He is currently Assistant Professor of Chemical Engineering and, by courtesy, of Materials Science and Engineering and Terman Faculty Fellow. Dr. Cargnello is author of more than 110 scientific articles and is the recipient of several awards including the ENI Award Debut in Research 2013, the European Federation of Catalysis Societies Award as best European Ph.D. thesis in catalysis in 2013, the Sloan Fellowship in 2018, the ANNIC Mid-Career Nanotechnology Scientific Award in 2019, and the Mitsui Chemicals Catalysis Science Award for Creative Work in 2020. General goals of the research in the Cargnello group pertain to solving energy and environmental challenges. Uniform and tailored nanocrystals and nanostructures are synthesized, studied and used for energy and environmental applications through catalytic processes, with emphasis on how to precisely control their structure to understand and exploit interactions between well-defined building blocks.

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