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Developing cation exchange as a viable strategy for nanoparticle synthesis

Semiconductor quantum dots (QDs) are promising materials with interesting, size-dependent properties. Although a few model systems (CdSe, PbS, and some others) have been developed, optimized, and thoroughly studied over the past few decades, there remain several obstacles that prevent their adoption in a variety of applications. One principal challenge is the inability to access a diverse range of QD materials with excellent control over size, shape, crystallinity, and surface chemistry. Control over these QD characteristics is crucial for the production of high-quality materials. Since direct synthetic approaches that afford such control have been elusive, we have been exploring cation exchange (CE) as a route to QDs with new compositions. To make CE a viable approach, it must be scalable, must be widely applicable, and must proceed to completion. Additionally, it is desirable to be able to achieve partial exchanges to produce alloy or heterostructures. I will summarize our progress on these goals to date.

Biography

P Gregory Van Patten is Professor and Chair of Chemistry at Middle Tennessee State University specializing in the study of semiconductor quantum dots (QDs). His recent focus has been the study of cation exchange as a means to access new types of QDs that are challenging or impossible to synthesize by more direct routes. In the past, Van Patten has also studied QD self-assembly in solution, resonance energy transfer between QDs, and ultrafast photophysics of QDs. After earning his Ph.D. in Chemistry at the University of South Carolina, Van Patten served as a postdoctoral associate at the Los Alamos National Laboratory, studying the light harvesting properties of polymer films impregnated with metalloporphyrins and related dyes. His work has produced over 40 publications and 2 patents. In 2008, he was awarded a Research Fellowship by the Alexander von Humboldt Foundation.

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