Complex Oxides Nanocrystals via Pulsed Laser Ablation

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Cutting-edge nanotechnology relies on the ability to understand and manipulate the wide-spectrum of nano-materials; and strong correlated complex oxides, with diverse intrinsic properties, dictate the material design in modern semiconductor industries and functional devices. From the growth aspect, since ternary or more oxides synthesis, for a long time, has posed a challenge to material scientists, it is necessary to explore/understand novel bottom-up nano-architecture. From the application aspect, as more and more advanced functionality development, nano-sized complex oxides become a treasure island and are still waiting to be fully exploited. Therefore, we propose to explore the 1D complex oxides nanocrystals via ambient pulsed laser ablation (PLA) fabrication (figure 1), a study that demonstrates a facile yet versatile bottom-up fabrication method as well as the new avenue for hybrid structure design in nanoscale.

In this study, choosing light-driven photocatalyst material, bismuth vanadate ($BiVO_4$) as a model system, we have successfully manipulated the mono-dispersed nanocrystals evidenced by X-ray diffraction, Raman spectroscopy, scanning electron microscopy and transmission electron microscopy (Figure 2). The optical and photocatalystic properties are characterized by diffuse-reflectance UV-visible absorption spectrum. In addition, the conjugation of gold- $BiVO_4$ is also investigated in order to enhance the photocatalystic activity. Therefore, featuring with the superior stability and variety of the design of as-grown nanocrystals, this work spreads the depth and width of functional complex oxides in nanoscale via PLA and is expected to benefit nano-material communication for the next generation nano-industries.

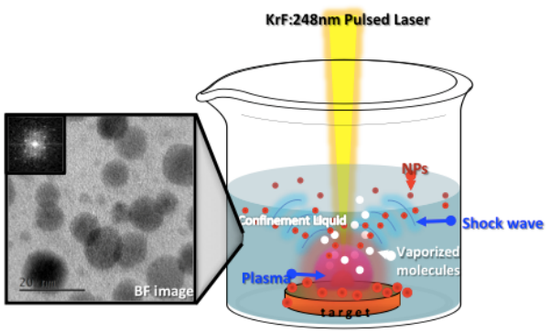

Figure 1.
The schematic of the pulsed laser ablation system. The bright field image shows the as-grown bismuth vanadate nanocrystals (fast Fourier transform is also shown as single crystal).

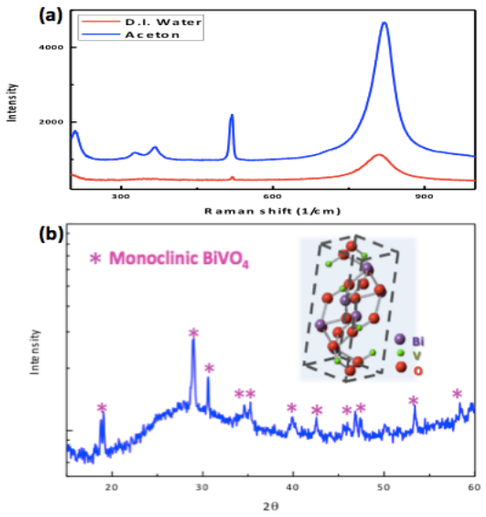

Figure 2.
Structural characterization is demonstrated by Raman spectroscopy (a) and X-ray diffraction (b). Both of them show the monoclinic (space group: I2/a) bismuth vanadate.