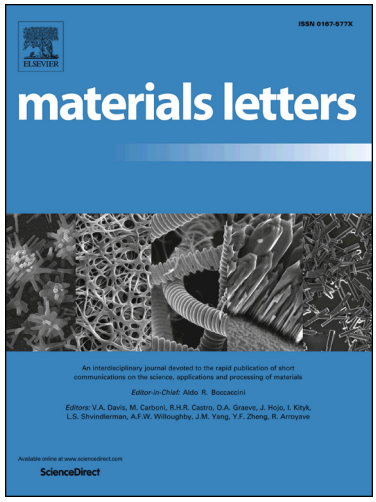

Nonlinear absorption and spatial self-phase modulation in Ag_2Se colloidal nanocrystals

Xia Wang, Yifan Yan, Hui Cheng, Yuhua Wang, Jun-Bo Han

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Nonlinear absorption and spatial self-phase modulation in Ag_2Se colloidal nanocrystals

Xia Wang[a], Yifan Yan[b], Hui Cheng[c], Yuhua Wang[c,*], Jun-Bo Han[b]

[a]*School of Mathematics and Physics,Wenhua College, Wuhan, 430074, P. R. China*

[b]*Wuhan National High Magnetic Field Center, Huazhong University of Science and Technology, Wuhan, 430074, P. R. China*

[c]*Hubei Province Key Laboratory of Science in Metallurgical Process, Wuhan University of Science and Technology, Wuhan 430081, China*

**Corresponding author. Email: wyh61@163.com*

Abstract: The third-order optical nonlinearities of Ag_2Se nanocrystals were investigated by using Z-scan techniques. Large optical susceptibility $\chi^{(3)}$ with the imaginary and real parts of 5.0×10^{-11} esu and $-(3.0\pm0.2)\times10^{-9}$ esu has been obtained under 1 mW laser excitation, which is believed to originate from the intrinsic nonlinearity of Ag_2Se nanocrystals. When 150 mW excitation power was applied, multiple diffraction rings were observed. The kinetic imaging results demonstrate that the rings originate from the self-phase modulations caused by the intrinsic nonlinearity and the thermal effect.

Keywords: Nanocrystalline materials; Optical materials and properties; Self-phase modulation.

1. Introduction

Colloidal metal chalcogenide quantum dots (QDs) have drawn increasing attention as a class of novel nano-sized materials, which have broad applications in optical switching, light trapping, and photo detection.[1-3] Great efforts have been taken to fabricate high-quality PbS, PbSe, and PbTe nanoparticles and explore their significant physical and chemical features, [4-7] These lead-, cadmium-, or mercury-containing QDs, however, are intrinsically toxic, which limits their applications. Therefore, materials with minimal toxicity and similar properties, such as silver chalcogenides, begin to draw more and more attentions recently. [8-10]

Silver selenide (Ag_2Se) is a promising candidate since it has excellent photoluminescence and light trapping properties in a broad wavelength range.[9,10] Many