UCF | NanoScience Technology Center

UNIVERSITY OF CENTRAL FLORIDA

GRADUATE RESEARCH SEMINAR SERIES

Friday
October 27, 2017

11:45 AM

Research Pavilion
NSTC
Conference Room 169

Pizza and drinks will be provided

2D TiS_2 Layers: A Superior Nonlinear Optical Limiting Material

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The advancement in high power lasers has urged the requisite of efficient optical limiting materials for both eye and sensor protection. The discovery of atomically thin 2D transition metal dichacogenides with distinctive properties has paved the way for a variety of applications including optical limiting. Until recently, the optical limiting effect exhibited by 2D materials is inferior to the benchmark materials fullerene (C_{60}) and graphene. This article reports the optical limiting activity of the 2D transition metal dichalcogenide, titanium disulfide (TiS_2) nanosheets, using optical and photoacoustic z-scan techniques. The 77% nonlinear optical limiting exhibited by the TiS_2 sheets with 73% linear-transmittance is superior to that of any other existing 2D dichalcogenide sheets, graphene, and the benchmark optical limiting material, C_{60}. The enhanced nonlinear response is attributed to the concerted effect of 2-photon and the induced excited state absorptions. By using photoacoustic z-scan, a unique tool developed to determine the nonlinear optical limiting mechanism in materials, it is found that the optical limiting exhibited by TiS_2 2D sheets and graphene are mainly due to nonlinear absorption rather than scattering effects. These results have opened the door for 2D-dichalcogenide-materials-based highly efficient optical limiters, especially at low fluences.