Ultrashort pulse laser assisted generation of layered nanomaterials in liquid

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This paper will present our recent work on the application of ultrafast lasers for the generation of layered nanomaterials. In particular, the photo-exfoliation of MoS_2 and WS_2 targets upon femtosecond laser processing in liquid media is presented. This procedure took place in low fluences and gave rise to the formation of few layer MoS_2 and WS_2 nanoflakes which was confirmed by Transmission Electron Microscopy and Raman Spectroscopy. Furthermore, the formation of fullerene-like spherical nanoparticles (NP) of MoS_2 and WS_2, using femtosecond laser ablation in water or ethanol is demonstrated. This procedure took place in high fluences, while remarkable dependence of the NP's morphology and structure on the repetition rate was observed. The NP colloids were characterized by Scanning Electron Microscopy, X-ray Diffraction, Transmission Electron Microscopy and Raman Spectroscopy. Raman Spectroscopy revealed large localized strain effects in the electronic band structure of atomically thin MoS_2 and WS_2. The mechanism of photo-exfoliation was investigated and discussed.

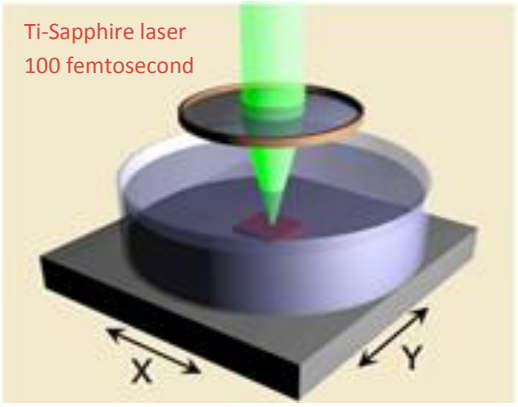

Figure 1: Experimental Setup of ablation in liquid by ultrashort laser pulses

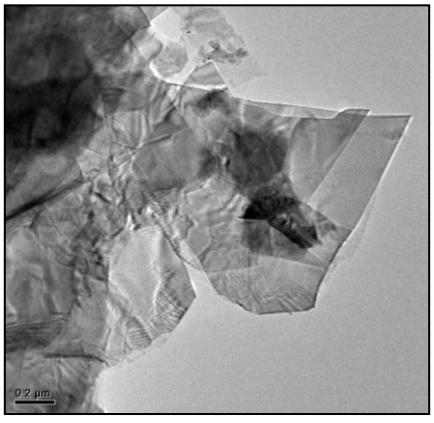

Figure 2: TEM view of MoS_2 flakes in water

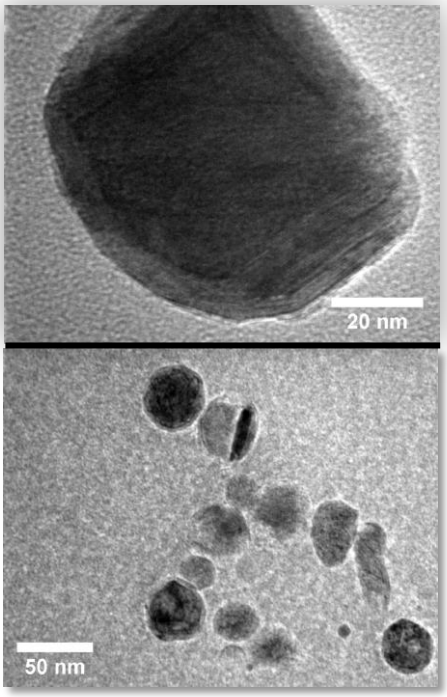

Figure 3: TEM view of WS_2 NPs in ethanol

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