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Nanosecond-Laser Generation of Chalcogenide Nanoalloys in Liquids: From Ablation to Application

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Selenium (Se) and Tellurium (Te) are bioessential elements that naturally occur in the human body but are under-utilized in medicinal treatments. Selenium exists as a micronutrient throughout most biological systems in the form of selenoproteins which play an important role in cell metabolism. Tellurium, belonging to the same family as selenium, has been poorly studied for its bioactivity. However, recent evidence points to its possible role in bioactivity, albeit to a lesser extent than selenium. Studies on these elements reveal that these elements may have therapeutic applications including antimicrobial, anti-inflammatory, anti-fouling and anti-cancer treatments. To achieve a green synthesis of the Se and Te nanoalloys free of harmful solvent byproducts, we utilize the technique of Pulsed Laser Ablation in Liquid (PLAL). The resulting nanoalloys are analyzed by electron microscopy and spectroscopic techniques to confirm shape, size, composition and crystallinity. Finally we demonstrate the potential biomedical applications for the resulting constructs which range from antimicrobial coatings, anti-cancer therapeutics to biosensors. The longterm impact of this work is to demonstrate that chalcogenide nanoalloys produced by PLAL techniques can form the basis of nature inspired nanoparticles for medicinal applications.

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