東京大学 THE UNIVERSITY OF TOKYO

工学系研究科専攻間横断型教育プログラム
「機械システム・イノベーション」

GMSI

最先端融合科学イノベーション
教育研究コンソーシアム

CIAiS

第203回GMSI公開セミナー／第27回CIAiSセミナー

Concurrent multi-beam multi-target pulsed laser deposition and matrix assisted pulsed laser evaporation (MBMT-PLD/MAPLE) for making organic-inorganic nanocomposite films for various applications

Professor Abdalla M. Darwish

Department of physics, Dillard University, LA, USA

日 時：2016年7月29日（金） 11:00～12:00
場 所：東京大学工学部2号館 3F 31A会議室

The Pulsed laser deposition has become a standard method to fabricate thin films of a complicated stoichiometry. PLD is a simple technique, which is very versatile technique to to be used with large array of materials. Yet, the technique was limited to its straightforward methodology. We have revolutionized the technique to double and triple PLD and MAPLE to MAPLE-D/TPLD which took the PLD to another level and opened a vast unlimited horizon to a different way of fabrication of devices and sensors. Huge variety of new devices, including light emitters, chemical sensors, and energy harvesters, can be made of the organic-inorganic nanocomposite thin films produced by the new concurrent multi-beam multi-target pulsed laser deposition and matrix assisted pulsed laser evaporation (MBMT-PLD/MAPLE) process. I will describe the MBMT-PLD/MAPLE system (its three-beam three-target version) that has been recently developed at Dillard University and the film deposition process itself. I will also report on the results of the investigation of optical and performance characteristics of three types of the fabricated nanocomposite thin film devices: upconversion light emitters, chemical (ammonia) sensors, and thermoelectric energy harvesters. The emitters were made of poly(methyl methacrylate) (PMMA) film impregnated with the nanoparticles of rare-earth (RE) fluorides, such as NaYF4: Yb3+, Er3+. They demonstrated bright upconversion emission in visible region being pumped with a 980-nm infra-red laser. The same films, but doped with an indicator dye, were tested as ammonia sensors. They demonstrated the drop of upconversion emission (registered by a photodetector) due to the rise of the optical absorption of the indicator dye affected by ammonia. The capability of detecting fractions of one percent (molar) of ammonia was established. The thermoelectric energy harvesters were made of polymer filler nanocomposite films of aluminum-doped zinc oxide (AZO) impregnated with polymer nano-fillers by the new methodology of the PLD/MAPLE techniaue. The role of the nano-fillers carbonized after heat treatment was to reduce the thermal conductivity and increase electrical conductivity thus contributing to the improvement of the thermoelectric figure-of-merit ZT.

主催： 東京大学大学院工学系研究科「機械システム・イノベーション」プログラム（GMSI）
「最先端融合科学イノベーション教育研究コンソーシアム」（CIAiS）

本件連絡先： 東京大学大学院工学系研究科機械工学専攻 准教授 塩見 淳一郎
GMSIプログラム事務局 E-mail: office@gmsi.t.u-tokyo.ac.jp Phone: 03-5841-0696