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## Growth and characterization of amorphous $V_2O_5$ quantum dots

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The amorphous quantum dots of $V_2O_5$ have been grown by a fairly simple and most common method of thermal evaporation. The growth flux rate is found to be crucial and important for controlling the dot size and its distribution.The linear relationship of dot size with growth time at low flux rate facilitates the growth of desired dot size. The Raman scattering analyses indicate an important fact that the similar short range order exists in quantum dots as that in crystalline phase. The value of μ=0.233 ($m_e=0.43m_o$ and $m_h=0.5m_o$) determined for amorphous phase from this study using the $E_g$(QD) versus $1/d^2$ plot compares very well with the literature values μ=0.162 ($m_e=0.24m_o$ and $m_h=0.5m_o$) for crystalline $V_2O_5$. The magnitude of blue shift in energy gap of the amorphous dots scales with dot size in the same manner as that of crystalline dots for $V_2O_5$. This study shows that the nature of quantum confinement in $V_2O_5$ dots is almost same in amorphous and crystalline phases. This similarity is quite interesting and motivating for further investigations both in device applications and basic research.

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## Graphene-based highly-sensitive immunoassays for *in vitro* diagnostics

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The last decade has witnessed exponentially growing applications of graphene in biosensors and diagnostics, mainly due to its low cost, absence of metallic impurities, high mechanical strength, excellent electrical conductivity, remarkable thermal conductivity and large surface area. We have developed graphene-based highly-sensitive immunoassays for *in vitro* diagnostics (IVD), which are based on the signal enhancement provided by graphene. The increased effective surface area provided by graphene-functionalization leads to higher antibody immobilization density that is responsible for signal enhancement. We developed graphene-based human lipocalin-2 (LCN2) immunoassay, which detected LCN2 in human plasma, serum and whole blood with the dynamic range and limit of detection of 0.6-5120 pg/mL and 0.7 pg/mL respectively. It is the most sensitive immunoassay for LCN2 detection, which has 80-fold higher analytical sensitivity and 3-fold reduced immunoassay duration than the commercially-available sandwich enzyme-linked immunosorbent assay (ELISA) kit. The anti-LCN2 antibody-bound microtiter plates (MTP) can be effectively stored for 8 weeks at 4°C in 0.1 M phosphate-buffered saline without any significant decrease in their functional activity. It has high precision based on its perfect correlation with commercial kit. Similarly, we have recently developed a potential graphene-based immunoassay procedure for point-of-care (POC) diagnostics. It involves the one-step kinetics-based immunoassay procedure on antibody-bound graphene-functionalized MTPs, which enables analyte detection in less than 30 min. The developed formats have potential applications for in IVD and POC diagnostics.

### Biography

Sandeep K Vashist is the Head of Immunodiagnostics at HSG-IMIT, Germany. After completing his PhD from Central Scientific Instruments Organisation (India) in 2006, he joined as a Scientist at Bristol-Myers Squibb Pharmaceutical Company, Ireland (2006-2009) and subsequently, as Team Leader at NUS Nanoscience and Nanotechnology Initiative, Singapore (2009-2012). He pioneered and transferred successfully many technologies to industries and healthcare; filed several patents; and, published extensively (>100 manuscripts) in high IF journals and prestigious conferences. Based on his research outputs, he has been awarded constantly by renowned institutions for scientific research excellence, innovation and performance; received the topmost research fellowships; and, awarded the invited memberships of societies such as RCS. He is the international expert reviewer for ~36 scientific journals (IF b/w 2.5-41) and numerous funding agencies; Executive Editor of J Basic Appl Sci and J Pharma Bioanal Sci; and Editorial Board member of J Nanomed Nanotech. His research interests are in the fields of nanotechnology, point-of-care devices, mobile Healthcare, immunodiagnostics and biosensors.

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