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Application of cyclohexeno-1, 2, 3-selenadiazole *via* extrusion of selenium in synthesis of copper indium diselenide

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Cyclohexeno-1,2,3-Selenadiazole is an organo-selenium compound and technologically important precursor. Organo-chalcogens particularly organo-selenium compounds have many useful applications in organic synthesis and pharmaceuticals. C-Se-N containing heterocycles can be exploited for their further use due to possible extrusion of Se by elimination of N₂ molecules. 1,2,3-selenadiazole was utilized as precursor for synthesis of CuInSe₂ (CISE) nanoparticles of various shape and size *via* thermal extrusion of selenium from cyclohexeno-1, 2, 3-selenadiazole (SDZ). The advantage of SDZ as a selenium precursor lies in its less stability towards thermal treatment leading to easy release of selenium at moderate temperature. The change in reaction temperature during synthesis of CISE exhibited change in physical properties of the CISE nanoparticles. The reactions performed at various temperatures showed variation in shape and size of the CISE nanoparticles which was confirmed by XRD, particle size analyzer, SEM and TEM analysis. Optical studies showed band gap in the range of 1.1-1.7 eV. Variety of shapes with lattice spacing of 0.33 nm corresponding to (112) crystal plane of CISE were confirmed from HRTEM analysis.



Scheme1: Possible mechanism of CISE formation.

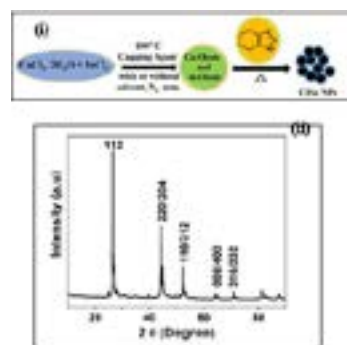


Fig. (i) Formation pathway of CISE and (ii) XRD pattern of CISE nanoparticles

Biography

Pawan K Khanna, the corresponding author was born on 23rd March, 1963 (Banda, UP). He completed his MSc from Bundel Khand University, Jhansi and went on to complete his PhD in Organometallic Chemistry of Se & Te from IIT Bombay in 1989-90 under the able guidance of Professor HB Singh. Subsequently, he went to Queens' University of Belfast and University of Wales at Swansea (UK) for his post-doctoral research in the group of Professor Christopher P Morley during 1989-1992. He returned to India and joined C-MET, Pune after a brief stint at Industry and IIT Bombay from 1993 to 1995. He was awarded the BOYSCAST fellowship of DST, Govt of India during 1998-99 to work on quantum dots driven from the organometallic chemistry at University of St. Andrews, Scotland (UK) with Professor David J Cole-Hamilton. He moved to his current position of Professor and Head of Applied Chemistry Department at Defence Institute of Advanced Technology (DIAT), a deemed University of the ministry of defence, govt of India, in 2011 where he was also dean of academic affairs at DIAT from March 2011 to March 2013. He has published over 150 research papers and has applied for more than 10 patents. He has guided more than 20 Master students and several young post-doctoral fellows as well as young scientists at his work place. Currently 8 PhD students are pursuing their research under his guidance on organometallic chemistry, materials chemistry and nanotechnology. He has completed 11 sponsored projects and was part of several national committees. He was awarded MRSI medal in 2010 and was declared Researcher of the Year at DIAT in 2014. He is the editorial board member of various international journals.

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