

# Seminar

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## Institute for Plasma Research

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- Title :** Deposition of Tungsten Coating using Cylindrical Magnetron System and Characterization
- Speaker :** Mr. Satyaprasad Akkireddy  
FCIPT, Gandhinagar
- Date :** 31 October, 2018 (Wednesday)
- Time :** 02.30 PM
- Venue :** Committee Room 3, (New Building), IPR

### Abstract:

Controlled thermonuclear fusion reactions are conducted in an experimental reactor known as a Tokamak. Plasma Facing Materials (PFM) of these fusion reactors have to fulfil very stringent requirements during their operation and Tungsten (W) is considered as one of the candidate materials for the same. However instead of using W as a bulk material (due to its high density and cost), it is also contemplated to use it as a coating.

In the present work, attempts were made to deposit W on graphite substrates using a cylindrical magnetron based Physical Vapour Deposition (PVD) technique. Process parameters were optimized for successful deposition of W. The effect of discharge power on morphology, chemical content, and deposition rate of coatings was studied. Further, the effect of substrate's surface roughness on the coating morphology was also studied. W coated graphite substrates were subjected to high heat-flux tests (up to 5 MW/m<sup>2</sup>) and the coatings' ability to survive the same was observed. Scanning Electron Microscope (SEM) was used for characterizing the deposited coatings.

W coatings of 3-6  $\mu\text{m}$  thickness were deposited on graphite substrates with a deposition rate ranging from 25 to 50 nm/min, based on the discharge power. Morphology of the deposited coatings was observed to be dependent on initial substrate roughness. Thermo-cyclic performance tests of these coatings indicate that W coatings could successfully withstand high heat flux loads, of up to 5 MW/m<sup>2</sup>, without exfoliation. However, the coatings have developed cracks after these tests and their intensity is observed to be high in substrates with high initial surface finish. Re-deposition of thin W coatings, using cylindrical magnetron technique, over the already deposited thick W coatings (using plasma spray technique) seems to improve the overall surface finish by reducing the surface porosity.

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