



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : Nikhil Rahul Dhongde

Roll Number : 196107013

Programme of Study : Ph.D.

Thesis Title: Theoretical and electrochemical investigation on controlling metal (carbon steel/ruthenium) dissolution in corrosive environments.

Name of Thesis Supervisor(s) : Dr. R. Prasanna Venkatesh

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SHORT ABSTRACT

This study investigates the corrosion protection of carbon steel (CS) and ruthenium (Ru) metal using various materials and techniques. In the first part, epoxy-based coatings with carbon-based fillers, such as graphene oxide functionalized with ionic liquid (FGO), were applied to CS in a 3.5 wt% NaCl solution, achieving nearly 99% corrosion protection, as confirmed by electrochemical tests and surface characterization. In the second part, carbon quantum dots derived from rice husks (RH-QDs) were incorporated into epoxy coatings to protect CS in the same corrosive environment, with results showing enhanced corrosion resistance and improved adhesion strength due to interactions between RH-QDs and the epoxy matrix. The third part focuses on the use of azoles (Imidazole, 1,2,4-Triazole, and 1,2,3-Benzotriazole) as corrosion inhibitors for Ru in an alkaline chemical mechanical planarization (CMP) process. Electrochemical data and quantum chemical simulations revealed that BTAH exhibited the highest inhibition efficiency due to stronger adsorption on the Ru surface, providing insights into the corrosion inhibition mechanisms at microscale level and contributing to the protection of metals in microelectronics fabrication.