

**Effect of Cerium Ions on the Corrosion of Galvanised Steel  
in 0.5M Na<sub>2</sub>SO<sub>3</sub> Solution**

**Submitted to the Central Department of Chemistry**

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**In Partial Fulfilment of Requirements for the**

**Master's Degree in Chemistry**

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**LETTER OF APPROVAL**

The dissertation entitled

**Effect of Cerium Ions on the Corrosion of Galvanised Steel in 0.5M  
Na<sub>2</sub>SO<sub>3</sub> Solution**

Submitted by

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## FOREWORD

The dissertation entitled “Effect of Cerium Ions on the Corrosion of Galvanised Steel in 0.5M Na<sub>2</sub>SO<sub>3</sub> Solution” submitted by Dharmendra Neupane for the M. Sc. Degree in Chemistry has been carried out under our supervision in the academic year 2010-2012. During the research period, he had performed his work sincerely & satisfactorily. No part of this thesis has been submitted for any other degree.

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## ABSTRACT

Chromate conversion coatings have been widely used in industry for a long time to improve the corrosion resistance galvanized steels. Hexavalent chromium, however, has high toxicity and carcinogenesis. Therefore, alternative and more environmentally friendly surface treatments need to be developed. Rare earth metal ions, such as cerium, is recognized as an effective corrosion inhibitor and environmentally friendly. In present study effects of Ce (III) and Ce (IV) ions on the corrosion behaviour of galvanised steel have been studied in 0.5 M Na<sub>2</sub>SO<sub>3</sub> solution. A composite coating of cerium and zinc has been prepared by pulse deposition technique and its effect on the inhibition of corrosion of galvanized steel has been evaluated in terms of  $E_{\text{corr}}$ ,  $I_{\text{corr}}$  and Tafel constants. It was found that the composite coating decreased the corrosion rate by more than 50 times. On the other hand, Ce (IV) ion was found to increase the corrosion rate due to taking part in cathodic reaction.

## ABBREVIATION

EIC	environmentally induced cracking.
SCC	stress corrosion cracking
HIC	hydrogen-induced cracking
CFC	corrosion fatigue cracking
EIS	electrochemical impedance spectroscopy
DHBA	3, 4-dihydroxybenzaldehyde
SEM	scanning electron microscopy
XPS	x-ray photoelectron spectroscopy
VIC	volatile corrosion inhibitors
FWHM	full width at half maximum

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