PREFACE

The sensitive and selective analysis of real chemical and biological samples has been a challenging requirement in analytical chemistry. Electrochemical sensors have shown potentiality for meeting the requirement of chemical sensing due to availability of various options in configuring the analytical systems feasible for real time analysis of targeted analyte. Electrochemical sensors/biosensors having specific chemical/ biochemical selective layer with potentiality for dealing real samples and are commercially available for specific applications in the area of food, medical and environmental analysis. Recent findings on the role of nanomaterials/nanostructure domain has revealed major contributions in signal amplification directing the need of novel research program oriented to the development of nanomaterial based electrochemical sensors which has been attempted in the current research program with specific attention on the use of nanomaterials made through sol-gel process.

The sol-gel process has received closer attentions of world scientists that allow the formation of nanostructured material from their suitable precursor's suspension under ambient conditions. Organic functionalities in alkoxysilane precursors allow to control the formation of nanostructured thin film of organically modified silicate (Ormosil) having biocompatibility and availability of options for the encapsulation of nanomaterials/electron transfer relay/biologically active material within nanostructure matrix with potentiality in realizing measurable rate of electron exchange during electrochemical sensing. The nanomaterial derived from the Titanium isopropoxide and Sodium tungstate as precursors of metal oxide. The presence of reactive organic functionality has shown for anchoring metal nanoparticles within ormosil network that dramatically enhances the sensing events. For example Palladium chloride specifically reacts with 3-Glycidoxypropyltrimethoxysilane

resulting into the formation of palladium-glymo complex that can be incorporated within ormosil network either as Pd-Glymo suspension or may be also incorporated even after calcinations at appropriate temperature along with metal oxides in powder form. The applications of these materials in chemical sensing are reported in present thesis.

The thesis has been focused to understand the role of metal oxide and other nanomaterials in the ormosil matrix from following angles: (i) the process of functionalized ormosil formation in absence and the presence of titania, (ii) the effect of titanium content on the thickness of ormosil film, (iii) the role of titania and palladium on the thickness of ormosil film, (iv) the effect of titania and palladium on the redox electrochemistry of ferrocene methanol and potassium ferricyanide within heterogeneous ormosil film and also in homogeneous solution, (v) the interaction of titania precursor and palladium-linked glycidoxypropyltrimethoxysilane in nanocomposite formation, (vi) to investigate the role of as prepared nanocomposite in electrochemical sensing, (vii) similar finding on the use of other metal oxide specifically WO_3 replacing titania during chemical/electrochemical sensing. The results on these lines on the development of nanostructured matrixes and their role in chemical sensing of ascorbic acid and hydrogen peroxide are reported the thesis.

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