Tuesday Afternoon Poster Sessions

Electrochemistry and Fluid-Solid Interfaces
Room: Exhibit Hall B2 - Session EC-TuP

Poster Session

EC-TuP1 A Potentiodynamic Study of the Influence of Chloride and Chromate on Passive Films on Copper, ***M.A. Hossain***, *M.Y.A. Mollah,* Lamar University*, D.E. Mencer,* Wilkes University*, R. Schennach,* Technical University of Graz, Austria*, H. McWhinney,* Prairie View A&M University*, D.L. Cocke*, Lamar University

Copper is being increasingly studied today because of its use for electronic interconnects, its resistance to corrosion and its structural and alloying properties even though it undergoes pitting corrosion in the presence of aggressive ions including chloride and bromide. In a research program to delineate the physical and chemical processes that control metal and alloy oxidation, we have found it necessary to explore in detail the oxidation of copper. Although the electrochemical oxidation of copper has been much studied, there is a need to examine the nature of the oxidation product films developed in the process in light of recent discoveries of the importance of the intermediate oxide, Cu_3O_2. In this study, the electrochemical oxidation of copper is examined in neutral solution by cyclic voltammetry and linear sweep voltammetry. The influences of chloride and chromate ions have been investigated. Chloride has been found to strongly influence the passive film and to produce additional chemical species in the product films. Chromate influences the electrochemical properties of the passive films by increasing resistance to corrosion and increasing resistance to electrochemical reduction during linear sweep voltammetry. The structural and chemical influences have been examined by SEM and XPS. The chemical and structural changes in the product films will be discussed in terms of the increasing body of information being determined on the nature of oxidation produced films on copper by thermal, electrochemical and plasma means.

EC-TuP2 Electrochemical Characterization and Preparation of Nanoporous Model Catalysts Produced from the Alloy $Cu_{77}Zn_{12}Mn_7Ni_4$, ***M. Kesmez***, *M.A. Hossain,* Lamar University*, D.E. Mencer,* Wilkes University*, H. McWhinney,* Prairie View A&M University*, D.L. Cocke*, Lamar University

In a research program to explore the preparation of model catalysts by the electrochemical oxidation of alloys, we have examined the oxidation of the $Cu_{77}Zn_{12}Mn_7Ni_4$ alloy to produce a nanoporous copper manganese oxide catalyst with supported nickel. This has been accomplished by the selective dezinfication of the alloy under oxidative potential control. The electrochemical properties of the alloy have been examined by cyclic voltammetry and linear sweep voltammetry to establish the mechanisms of corrosion and the characteristics of the oxidized films. The electrochemical characteristics needed for catalyst design will be delineated. The structural and chemical properties of the product films have been examined by SEM and XPS before and after thermal treatments to produce the active catalysts. The electrochemical preparation of the model hopcalite catalyst will be discussed in terms of the previous preparation of the catalyst by thermal and plasma chemical means. The potential of electrochemically controlled dezinfication of this type alloy will be discussed for the production of new nanoporous model catalysts.

EC-TuP3 The Electrode Processes of Iron at Potentials Beyond the Stability Limits of Water, ***S.R. Pathak***, Lamar University*, J.R. Parga,* Instituto Technologico de Saltillo, Mexico*, D.E. Mencer,* Wilkes University*, G. Irwin, D.L. Cocke,* Lamar University

The increasing use of iron electrodes in electrochemical processes that operate beyond the stability limit of water has created a critical need for the delineation of the irreversible interfacial processes affecting performance. These include the production of a range of aqueous iron species, a number of oxyhydroxides and several oxides that are released to the aqueous phase or remain attached to the electrode surfaces. We have examined the performance of iron electrodes in a five electrode arrangement with three bipolar and two monopolar electrode systems. The electrochemical reactor has been examined by the Cell Design 2000 software by LCHEM® to produce potential distribution and current distributions. The local electrodics are compared to the model calculations. The electrode surfaces residues have been examined by linearsweep voltammetry. The solids have been characterized by SEM, XRD, FTIR and Mossbauer Spectroscopy. The iron oxide and oxyhydroxide phases produced display strong dependence on pH. The results will be discussed in the context of the prevalent chemical and physical mechanisms and the influence on the performance of systems such a electrocoagulation, electrodecantation and electroflotation will be delineated.

EC-TuP4 Microstructure in Selective Electrodeposition of Copper on Indium-Tin-Oxide Film, ***S. Asakura***, *M. Hirota*, *A. Fuwa*, Waseda University, Japan

This paper describes the use of electrodeposition process to fabricate copper micropatterns on indium tin oxide (ITO) surface using patterned self-assembled monolayers (SAMs) as templates. Thin film ITO has good conductivity and excellent transparency in the visible region, but very few attempts have been made on fabrication of SAMs and electrodeposition of copper on ITO substrates. Micropatterned copper, which has been widely used because of its high electrical conductivity and low cost, is a key requirement since copper provides us with the electronic circuit wires which send signals to the functional molecules on them, electrochromic materials like a part of display, and biosensor. In our study, the organosilane SAMs have been prepared from octadecyltrimethoxysilane (ODS) by chemical vapour deposition (CVD) and irradiated through a TEM grid as a photomask by vacuum ultraviolet (VUV, 172 nm) light for removal of selected SAMs region and creation of electrode region for copper deposition. Lateral force microscopy (LFM) has been used to evaluate the friction differences between photoirradiated and unirradiated areas. SAMs and ITO regions have been also characterized by cyclic voltammetry (CV), from which we could decide selectively electrodeposition condition. It has been found possible to have micropatterned copper utilizing SAMs blocking effect in preventing electron transfer from species in solution through electrodeposition.

EC-TuP5 Characteristics of the Polymer formed on via Sidewall during RIE Process and its Removal, ***J. Song***, *J. Kim,* Samsung Electronics Co., Ltd., Korea*, H. Seo, Y. Kim, H. Jeon,* Hanyang University, Korea

Via contact holes, act as electrical connection between the upper and lower metal layers through inter-metal dielectric, are generally patterned by photo lithography and reactive ion etching (RIE) processes, and the patterned photoresist after the formation of via holes is conventionally removed by the combination of remote plasma ashing and wet organic stripping. It is very critical to remove completely polymer formed on via sidewall and bottom during RIE process to have reliable metal filling and good contact resistance. Via holes were formed by using RIE process with CHF_3/CF_4 gas under the same processing conditions for the state-of-the art DRAM process. The surface morphology of polymer before and after cleaning process was observed by using in-line scanning electron microscopy (SEM), vertical SEM and transmission electron microscopy (TEM). The chemical compositions and structures of polymer were analyzed by using energy dispersive spectroscopy (EDS) and Auger electron spectroscopy (AES). TEM and EDS study revealed that the side wall polymer were grown from the cap TiN layer on Al and showed the truncated cone shape with the thickness in the range of 200~400Å. This indicates that via polymer layer becomes a very critical issue when the etch stop layer is TiN. Bottom polymer layer showed double layer structure with two distinct chemical compositions. The lower layer with the thickness of about 50Å showed a similar chemical characteristic to the side wall polymer while the upper polymer layer with the thickness of about 200Å showed no fluorine content. In this study, we will investigate the removal characteristics of polymer during RIE process at various ashing and stripping conditions. Preliminary results indicated that the low temperature remote oxygen plasma ashing and hydroxylammoniumsulfate based wet stripping were very effective to remove polymer formed on the side and bottom of via holes during RIE process.

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