

# **ELECTRODEPOSITION OF METALLIC LAYERS FROM APROTIC ELECTROLYTES**

Ing. Martin DOČKAL, Doctoral Degree Programme (1)  
Dept. of Electrical and Electronic Technology, FEEC, BUT  
E-mail: xdocka04@stud.feec.vutbr.cz

Supervised by: Prof. Jiří Vondrák

## **ABSTRACT**

Theoretic part of this work contains a survey of the fundamentals of electrode processes with emphasis on galvanic metal deposition. The experiments with cadmium electrodeposition from liquid cadmium perchlorate solution in propylene carbonate, and from cadmium containing PMMA based gels are described in experimental part. The morphology of deposited metallic cadmium on copper was observed by scanning electron microscope. Dendritic growth and of the substrate and fine deposit organic compounds containing film was formed from liquid electrolyte, while corrosion appeared in contact with the gel.

## **1 INTRODUCTION**

First, the basic concepts of galvanic electrodeposition will be surveyed. The preparation of aprotic electrolytes (both liquid and gelous polymeric ones) and subsequent galvanic electrodeposition of metals will be described in experimental part. The morphology of the layers formed under named experimental conditions will be investigated using an environmental scanning electron microscope.

## **2 ELECTROLYTES**

Liquid electrolytes were prepared as solutions of metal perchlorates in propylene carbonate. The same solutions were used for the preparation of gels by an addition of Superacryl (methylmethacrylate resin prepared by polymerisation of methylmethacrylate and commercial polymerization agents) [1]. A rather tough gel was formed in 24 hours.

The use of PVC as gel forming agent was unsuccessful.

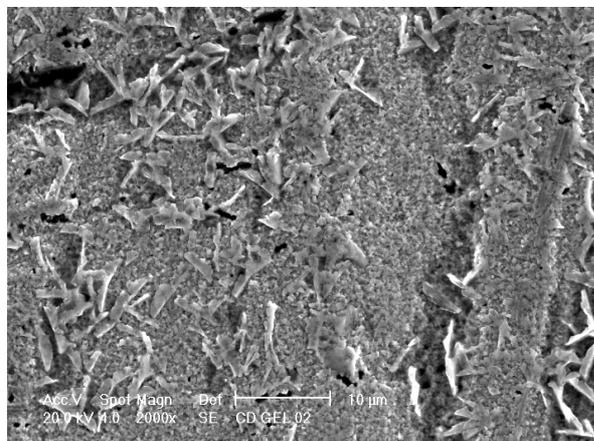
## **3 METAL DEPOSITION**

The electrodeposition was performed on copper and/or cadmium electrodes, both from liquid and gel electrolytes [2, 3]. The influence of time on the process was studied. The

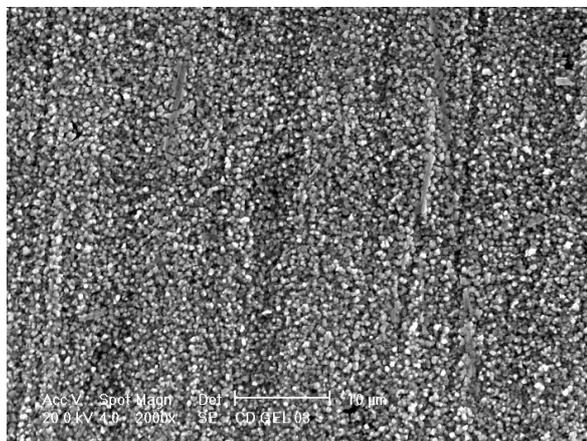
current decreased from initial value almost to zero and it remained on that level for the whole time interval of the experiment. Then all remnants of the gel were removed from the electrode surface by rinsing in chloroform. No differences were observed between the electrodeposition on copper and cadmium substrates. Copper electrodes were used for further experiments.

#### 4 DISCUSSION

All samples obtained from gel polymer electrolytes follow more or less the original relief of the starting electrode surface such as is the set of parallel grooves. The influence of surface homogeneity on dating of used gel polymer electrolytes is displayed on figs. 1 and 2. fig. 1, gel age 72 hours shows eliminating of cadmium formed as needles on granulated base. fig. 2, gel age 168 hours, shows eliminating only granulate base and the result gets better homogeneity.



**Fig. 1:** Electrode surface on exp. 10 µm, gel age 72 hours



**Fig. 2:** Electrode surface on exp. 10 µm, gel age 168 hour

Electropolishing of the electrode surface would be important. In future, co-deposition of various metals (electrochemical deposition of alloys) will be the subject of following investigations.

#### REFERENCES

- [1] Vondrák, J., Sedlaříková, M., Reitr, J., Hodal, T.: *Electrochim. Acta* 44 (1999) 3067-3073
- [2] Vondrák, J., Sedlaříková, M., Velická, J., Klápště, B., Novák, V., Reitr, J.: *Electrochim. Acta* 48 (2003) 1001-1004
- [3] Dočkal, M.: Diploma Thesis, VUT Brno, 2003