

COHERENT RESEARCH OF METAL DEPOSITION ON D263 GLASS USING LASER PULSES AND CHEMICAL ETCHING

Kamilė Kasačiūnaitė^{1,2}, Antanas Urbas^{1,2}, Sergej Orlov¹, Ina Stankevičienė¹, Aldona Jagminienė¹

¹ Coherent Optics Laboratory, Center for Physical Science and Technology, Vilnius, Lithuania

² Altechna R&D Ltd, Vilnius, Lithuania

kamile.kasaciunaite@wophotonics.com

Microelectronics has been rapidly evolving as the most in-demand field of electronics because of the ever-increasing demand for inexpensive and lightweight equipment. Materials such as silicon and copper are commonly used in manufacturing microelectronics. Therefore, direct metalization of bare glass with copper is required to reach the full potential of low-cost benefit [1]. Two step process is needed to obtain precise microstructures in glass before metal deposition: 1) create structures in glass using femtosecond laser 2) use alkali etching for via holes in the material. In this report we research a fundamental material challenge, associated with copper-to-glass adhesion.

Raman spectroscopy is a powerful method for determination of glassy material analysis. The chemical composition and structure of molecules influence the scattering and no two of the spectra being exactly similar [2]. Using Raman spectroscopy in D263 glass we indicate different chain lengths of SiO₄ tetrahedral structures. These links are specified in Q_n parameter, which describe quantity of bridging oxygens in the structure. Using laser pulses these tetrahedral chains can be contracted by creating shorter structures than the origin. Therefore, laser densified area acquires a greater reactivity to Potassium hydroxide (KOH) etchant and facile Si-O-Si cleavage [3], consequently we are observing a selective chemical etching. These two processes take place in designing desired microstructure in dielectric material.

Finally, creating laser and chemical etchant modifications in glass a selective metal deposition was witnessed. It has been a clear connection between metal deposition speed on the glass and laser pulse energy as well as chemical etching.

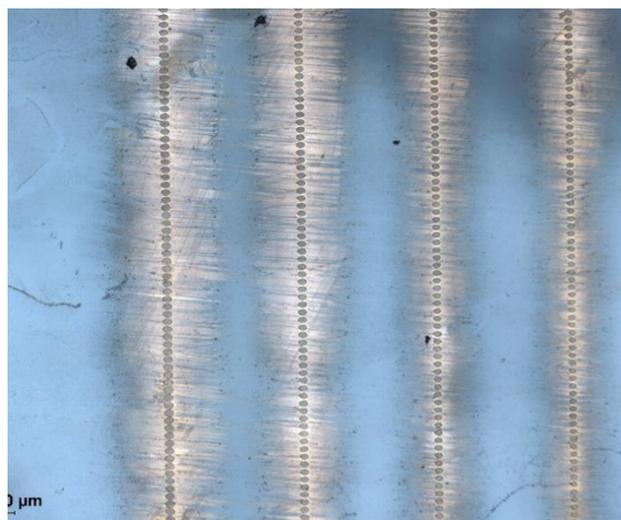


Fig. 1. Energy and copper deposition on borosilicate glass dependency. As energy from left to right decreases the amount of copper deposition decreases as well.

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[3] S. Kiyama, S. Matsuo, S. Hashimoto, Y. Morihira, Examination of Etching Agent and Etching Mechanism on Femtosecond Laser Microfabrication of Channels Inside Vitreous Silica Substrates, J. Phys. Chem. C 2009.