

The influence of solvents on the potential of the InSb self-dissolution process in $I_2 + HI$ (methanol, DMF) etchants

G.P. Malanych¹, R.O. Denysiuk², V.M. Tomashyk¹, M.V. Lozova²

¹*V.Ye. Lashkaryov Institute of Semiconductor Physics, NAS of Ukraine,
41 Nauki Ave., Kyiv 03028, Ukraine, galya.malanich@gmail.com*

²*Ivan Franko Zhytomyr State University,
40 Velyka Berdychivs'ka Str., Zhytomyr 10008, Ukraine*

Potentiometric studies of InSb dissolution in $I_2 + HI$ (methanol, DMF) etchants allowed us to identify possible processes occurring at the phase interface. The electrode potentials of the InSb self-dissolution process in $I_2 + HI$, $I_2 +$ methanol, and $I_2 +$ DMF solutions are within the ranges of 0.04–0.06 V, 0.29–0.32 V, and 0.24–0.19 V, respectively (Fig.). It was found that an increase of the iodine content in the etching compositions leads to a slight increase in the electrode potentials of InSb self-dissolution in $I_2 + HI$ (methanol) etchants and a slight decrease in the case of $I_2 +$ DMF.

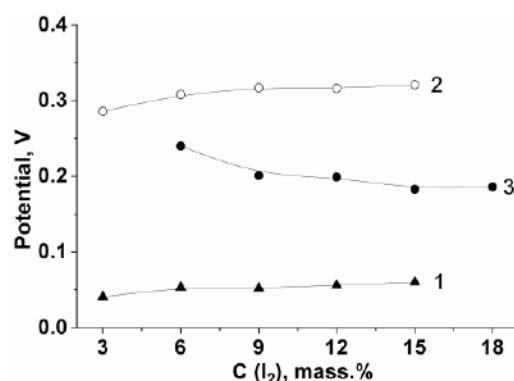


Fig. Dependence of the values of electrochemical potentials of InSb self-dissolution on the concentration of iodine in etching solutions: 1 – $I_2 + HI$, 2 – $I_2 +$ methanol, 3 – $I_2 +$ DMF ($T = 293 \pm 0.5$ K)

Based on the obtained experimental data, it was established that etchants based on the iodine solutions with redox potential > 0.04 V can be used for chemical-dynamic polishing of the InSb surface, and the limitation of the InSb dissolution process is determined by the transfer of antimony ions into the etchant composition. The increase in the redox potential of the polishing solutions may be due to the absence of spontaneous processes, such as partial hydrolysis, which reduce the energy costs of activating the chemical interaction.

Acknowledgements. The work was partially implemented through budgetary funding of the project No III-10-24 of the National Academy of Sciences of Ukraine. The authors are sincerely grateful to all the defenders of Ukraine and emergency workers who made publication of the research results possible.