

**INTERFACIAL ENERGIES AND SURFACE MASS TRANSPORT IN POLYCRYSTALLINE MgO****A. Christogerou, S. Bebelis, P. Nikolopoulos\***

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\* [nikolop@chemeng.upatras.gr](mailto:nikolop@chemeng.upatras.gr)**ABSTRACT**

The aim of the present work is the determination of the temperature dependence of the surface energy and the grain boundary energy of polycrystalline MgO. Furthermore, this work yields information about the mechanism and the kinetics of mass transport in the grooving process at the grain boundaries/free surface intersection of MgO. From an application point of view, investigation of MgO in the present work is associated with its possible application as ceramic insulation layer in combination with air braze filler metals to join the metallic components in planar solid oxide fuel cell stacks, alternatively to the currently used glass ceramic solders [1].

The sessile drop technique was used to measure the contact angles,  $\theta$ , of the liquid metals Ag and Cu in contact with polycrystalline MgO in the temperature ranges 1293-1623 K and 1393- 1633 K, respectively, in Ar/4%H<sub>2</sub> atmosphere [2]. The measured contact angles indicated non-wetting ( $\theta > 90^\circ$ ). Combination of the experimental results with literature data for non-wetted and non-reactive oxide/ liquid metal systems [3] permitted the calculation of the temperature dependence of the surface energy of MgO. Thermal etching experiments in argon atmosphere on the grain boundaries intersecting the surface of the polycrystalline ceramic allowed determining the formed groove angles,  $\psi$ , with respect to temperature and time, as well as the grain boundary energy [4]. Grain boundary grooving studies in the temperature range 1473-1773 K showed that surface diffusion is the dominant mechanism of mass transport in MgO [5].

**KEYWORDS:** Wettability; Surface and grain boundary energies; Groove angle; Surface diffusion coefficient**REFERENCES**

- [1] Chatzimichail, R, Triantafyllou, G., Tietz, F., P. Nikolopoulos, P. (2014). *J. Mater. Sci.* 49:300–313.
- [2] Nikolopoulos, P. (1985). *J. Mater. Sci.* 20:3993–4000.
- [3] Zouvelou, N., Mantzouris, X., Nikolopoulos, P. (2007). *Int. J. Adhes. Adhes.* 27:380–386.
- [4] Tsoga, A., Nikolopoulos, P. (1994), *J. Am. Ceram. Soc.* 77:954–960.
- [5] Chatzimichail, R., Christogerou, A., Bebelis, S., Nikolopoulos, P. (2021). *J. Mater. Eng. Perform.* 30:9130-9139