Formation of Chemical and Phase Composition of Porous Transition Metal-based Alloys During Vapor Phase Dealloying

Olexiy Yakovenko[1], Oleksandr Roik[1, a)], Peter Švec[2], Dusan Janickovic[2], Mykhailo Turchanin [3], Pavlo Agraval,[3] and Peter Švec Sr.[2]

[1] *Taras Shevchenko National University of Kyiv, Faculty of Chemistry, Kyiv 01033, Ukraine*
[2] *Institute of Physics, Slovak Academy of Sciences, Dúbravská cesta 9, 845 11, Bratislava, Slovak Republic*
[3]*Donbas State Engineering Academy, Akademichna Street 72, Kramatorsk 84313, Ukraine*

[a)] *Corresponding author: oleksandr_roik@knu.ua*

Abstract. The formation of a porous structure during the vapor-phase dealloying (VPD) of multicomponent transition metal (TM) precursor alloys was investigated. The influence of the precursor fabrication methods on the chemical and phase composition of the resulting porous metallic materials is demonstrated. The presence of residual zinc was confirmed in all fabricated alloys, with its content increasing with the extraction depth. The microstructure of the precursor alloys is based on a pure zinc phase and several zinc-based intermetallic phases. During dealloying, a three-dimensional porous structure was formed, which consisted of one or more TM-based solid solutions with an FCC lattice. Thermodynamic simulation of the Co-Cu-Fe-Ni system was performed using the CALPHAD method, yielding results consistent with experimental X-ray diffraction (XRD) data. Finally, the challenges of synthesizing high-entropy porous metallic materials via VPD are discussed.