Reduction of the Thermal Conductivity by the Nanostructuration of Electrodeposited CuNi Alloys

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The application of inexpensive and scalable materials in the industry for thermoelectric applications has received great interest, such as CuNi alloys in the last ears. Nanocrystalline CuNi alloys with different compositions were grown by pulsed electrodeposition reducing the crystallite size of the CuNi down to 30-40 nm by the incorporation of saccharine in the electrolyte [1]. The thermoelectric properties, such as electrical conductivity, Seebeck coefficient, and thermal conductivity of these nanocrystalline alloys, were studied. The maximum figure of merit at room temperature obtained was (6.4 ± 1.5) $\cdot 10^{-2}$ for nanocrystalline $Cu_{0.65}Ni_{0.35}$. The thermal conductivity of CuNi alloys was reduced by the nanostructuration to a value of 9.0 ± 0.9 W/m·K, making these nanocrystalline CuNi alloys more competitive than other more classical thermoelectric materials [2]. This work opens a new field to be investigated, that can be described as the use of commercial alloys such as CuNi for thermoelectric applications, and shows the use of a new approach to enhance the thermoelectric properties of inexpensive and/or fewer pollutant materials.

References

[1] Cristina V. Manzano, Patrik Schürch, Laszlo Pethö, Gerhard Bürki, Johann Michler, and Laetitia Philippe, *Journal of The Electrochemical Society*, 166 (10), (2019) E1-E7 (2019).

[2] Cristina V. Manzano, Olga Caballero-Calero, Maxime Tranchant, Enrico Bertero,Pablo Cervino-Solana, Marisol Martin-Gonzalez and Laetitia PhilippeJ. Mater. Chem. C, 9 (2021) 3447.

Figures

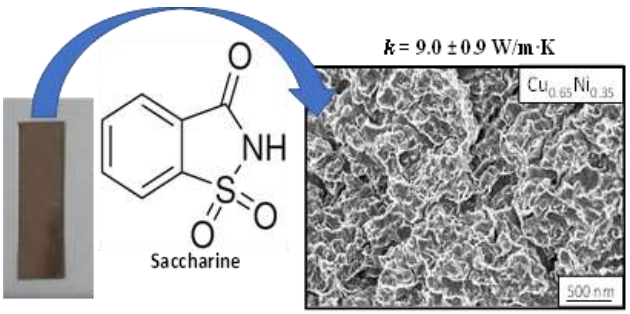

Figure 1: The thermal conductivity of CuNi alloys is reduced by the nanostructuration.