Extreme biomimetic approach: melting of steel and copper on carbonized 3D spongin scaffolds

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INTRODUCTION: Spongin is a naturally occurring renewable biopolymer of marine sponges origin. In cultivated bath sponges, spongin – based skeletal 3D constructs have been characterized by thermostability up to 360 °C, elasticity, durability, porosity, flexibility and compressibility. This unique biomaterial can be carbonized at tempatures over 1000 °C with transformation into graphite without loss of its 3D architecture [1]. The aim of this study was to investigate melting behaviour of still and copper on the surface of carbonized spongin scaffolds.

METHODS: Diverse types of steel in the form of shavings or powders as well as copper powder have been melted on selected carbonized spongin templates in the furnace at temperatures of 1450 ºC/1600 ºC in argon atmosphere for 90 min. Obtained phases were analysed using digital optical microscopy, SEM /EDS and elemental mapping technics.

RESULTS: Due to the reaction of the carbonized spongin with steel or copper during melting, novel 3D composite materials never reported before have been developed and characterized (Figure 1, 2).

CONCLUSIONS: Due to the nanocrystalline metallic phase which is homogenously distributed on the surface of carbonized sppongin, microfibres separated from the metallized 3D construct show the appearance of magnetic properties only in the case of iron – spongin composites.

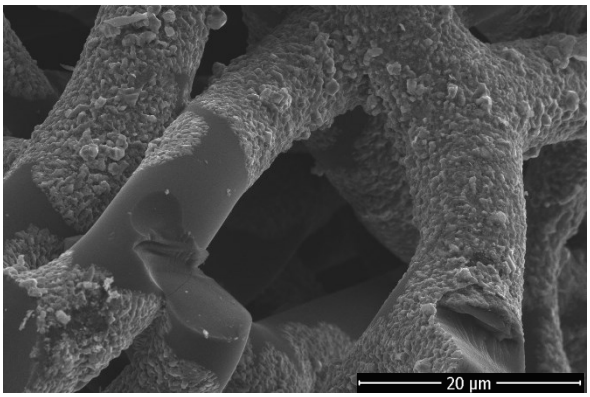

Figure 1. Stainless steel 316 L powder after melting on carbonized spongin scaffold at 1450 ºC for 90 min at argon atmosphere.

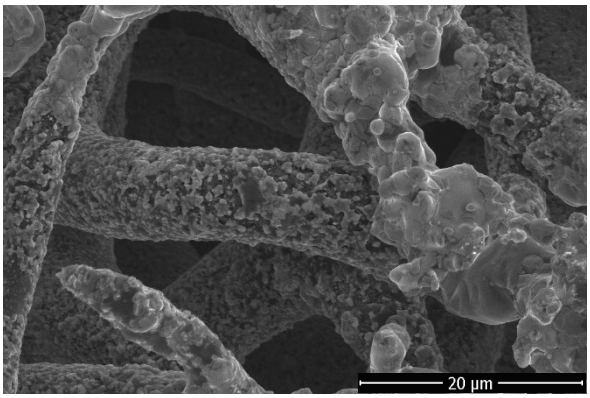

Figure 2. Construction steel EN S235JRG2 (AISI 1015) after melting on carbonized spongin scaffold at 1450 ºC for 90 min at argon atmosphere.

ACKNOWLEDGMENTS: This research was funded by the National Science Centre (Maestro No. 2020/38/A/ST5/00151).

REFERENCES:

[1] Petrenko et al., (**2019**), *Sci. Adv*. 5(10): eaax2805., doi: 10.1126/sciadv.aax2805.