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Editorial

Mechanical and Microstructural Characterization of Metals and Alloys

Silvia Barella [1] and Dario Ripamonti [2,*]

1 Dipartimento di Meccanica, Politecnico di Milano, Via La Masa 1, 20156 Milano, Italy; silvia.barella@polimi.it
2 Institute of Condensed Matter Chemistry and Technologies for Energy (ICMATE), National Research Council of Italy (CNR), Via R. Cozzi 53, 20125 Milano, Italy
* Correspondence: dario.ripamonti@cnr.it

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In order to design a fully functional manufactured component the designer needs a deep understanding of the materials behavior, which includes not only its in-service performance but also the effect of the processing routine. This knowledge is essential for the efficient use of resources, which can give positive fallout, both economic and environmental.

Material properties are usually investigated through laboratory testing, but this practice can be unfit to mimic actual working conditions, so it is crucial not only to describe the materials' response on a laboratory scale, but also to explore the underlying active mechanisms on a physical basis. This task can be accomplished if the materials' properties are interpreted in the light of microstructure analysis.

In reference [1], the authors face a biocompatibility issue regarding implant materials. The performance of the base material, the relatively common Ti-6Al-4V, was measured in terms of corrosion resistance in Ringer's solution, and significant improvements were observed after a heat treatment routine which enhanced the β-phase content. The presence of this phase was detected through X-ray diffraction analysis and scanning electron microscopy observations. Therefore, a process-related feature (namely, heat treatment) led to a higher performance, and microstructural analyses explained why it happened.

Another example of the complex relationship between the desired properties and the process routine can be found in reference [2]. A Co-Cr-Mo alloy can be a good option as a biomaterial because of its excellent mechanical properties, corrosion resistance, and biocompatibility. These features are limited by limited workability, which makes it difficult to achieve the desired shape. This can be done with a novel technique, developed by the authors, and already used with other high melting point materials with low workability.

In reference [3], the authors focused on the optimal solution to the problem of joining a high entropy alloy, a relatively new class of materials with outstanding properties, with a 316 stainless steel through brazing. The authors found an effective way to join a "new" material to an "old" one, which could lead to new applications.

The examples here provided show that, with the aid given by laboratory analyses, it is possible to understand not only what the best solutions are, but also why they are so. In this process, new ideas may arise, in a continuous effort towards improvement.

References

1. Luqman, M.; Seikh, A.H.; Sarkar, A.; Ragab, S.A.; Mohammed, J.A.; Abdo, H.S. Comparative Study of the Electrochemical Behavior of α and β Phase Ti6Al4V Alloy in Ringer's Solution. *Crystals* **2020**, *10*, 190. [CrossRef]
2. Abe, S.; Yokota, Y.; Nihei, T.; Yoshino, M.; Yamaji, A.; Toyoda, S.; Sato, H.; Ohashi, Y.; Kurosawa, S.; Kamada, K.; et al. Control of Microstructure for Co-Cr-Mo Fibers Fabricated by Unidirectional Solidification. *Crystals* **2020**, *10*, 11. [CrossRef]
3. Lin, C.; Shiue, R.-K.; Wu, S.K.; Lin, Y.S. Dissimila Infrared Brazing of CoCrFe(Mn)Ni Equiatomic High Entropy Alloys and 316 Stainless Steel. *Crystals* **2019**, *9*, 518. [CrossRef]