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Nitrogen ion implantation of AlCoCrFeNiTi0.2 High Entropy Alloy

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With constant increase in understanding of High Entropy Alloys (HEAs), surface treatment investigations have been becoming more viable taking into consideration a numerous phenomena that could occur. Alternating surface layer properties, especially mechanical properties, can be achieved by ion implantation. Ion implantation introduces relatively high-energy ions into the surface of the sample significantly changing its structure. This technique is well-known being able to increase the hardness but in general it depends on many factors, primarily kind of ions as well as their energy and dose.

In this work, we investigated the influence of nitrogen ions implantation into the surface of AlCoCrFeNiTi0.2 HEA on mechanical properties of as-received surface layer. X-Ray Diffraction (XRD) showed that virgin sample consisted of σ and body-centered cubic (BCC) and due to implantation σ–to-BCC phase-transformation occurred. It was relatively independent from ion dose/fluence. However, local mechanical response was improved for both phases separately as well as in general (indentation size bigger than domain). Also, usually increase in hardness is followed by embrittlement. To address that problem, we calculated hardness H to Young's Modulus E ratio and we observed its increase after implantation. This can be associated with decrease with brittleness.

The idea of research and results are summarized in Figure 1. Those results can be promising for harsh environments, such as space or nuclear applications, were stable properties are important as well as improved surface properties play a role.

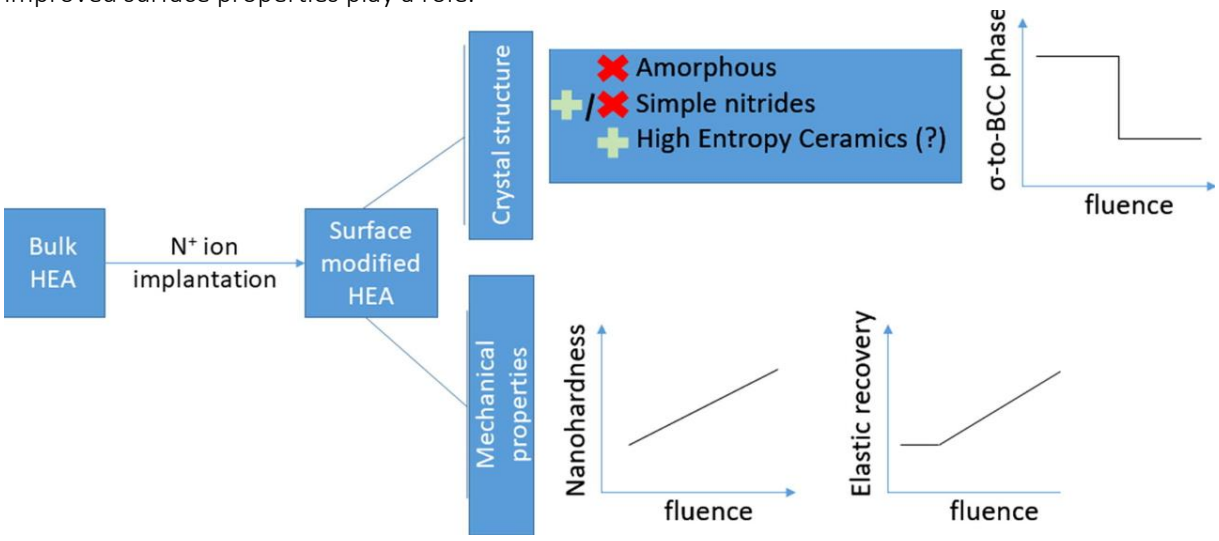

Figure 1. Results of our work [1].

References

[1] P. Jenczyk et al. *Materials & Design*, 2022, *Vol.216*, 110568-1-11.