

IMPLANTATION OF HE AND KR IONS IN METALS AND POLYMERS

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Metallurgy has been in existence for thousands of years [1], hence a new approach to the improvement of metal alloys seems nearly impossible. On Sverker 21 (traditional) and Vanadis 6 (advanced powder) steel surfaces we performed: grinding, turning, and turning + slide burnishing. Then we applied in turn focused ion beams of He or Kr up to fluences of 10^{15} ions/cm² and finally to scratch resistance testing. Ion implantations have not been applied to metals before. Acoustic signals show that Kr implantation reduces microcracks while He ions almost completely eliminate them. He ions fitting between the iron atoms increase the resistance against scratching, larger Kr ions produce the opposite effect [2]. Self-organization has been explained by Desai and Kapral [3] while the driving force for surface transformations is energy minimization [4].

We are now applying turning and turning plus slide burnishing to Teflon and also to composites such as 60 wt.% Teflon + 40% bronze. These techniques have not been applied to polymers or polymer-containing composites before. Then these materials will be subjected to He & Kr ion implantation similarly as steels and further studied by scratch resistance testing including the acoustic signal and microscopy.

References:

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