Contribution ID: **12** Type: **Poster**

Plasma nitriding properties of sintered body formed using CoCrFeNiMn high-entropy alloy powder by varying ball-milling duration

Wednesday, 7 September 2022 18:02 (2 minutes)

Recently, it has been reported that CoCrFeNiMn high-entropy alloy (HEA) has excellent tensile strength and ductility at HEA at low temperatures. Through plasma nitriding at 673 K, an expanded fcc structure was formed on the surface of the HEA. Another study observed that dislocations were introduced on the surface of CoCrFeMn alloy powder through ball-milling. Simultaneously, strength improvement and strain hardening were observed. This study aims to evaluate the characteristics of the nitrided layer by performing DC plasma nitriding (S-DCPN) treatment on the sintered body of the HEA powder after ball-milling. The ball-milling was conducted on gas-atomized CoCrFeNiMn HEA powder samples for time periods ranging from 0 to 15 h to prepare a sintered body. Subsequently, this sintered body was subjected to S-DCPN treatment at 673 K for 15 h, at a gas pressure of 200 Pa under 75%N2-25%H2. During the plasma nitriding process, an austenitic stainless-steel screen was installed as an auxiliary cathode to ensure uniform heating and an increased nitrogen supply. Furthermore, the nitrided sample was subjected to X-ray diffraction (XRD) test, cross-sectional microstructure observation, surface morphology observation, cross-sectional hardness test, glow discharge optical emission spectroscopic analysis (GD-OES), corrosion test, and wear test. The XRD and GD-OES results showed that N concentration on the surface decreased with the ball-milling duration. After a wear test, the width and depth of the wear marks decreased with increasing ball-milling duration, thus exhibiting an increased wear resistance.

Speaker Country

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Session Classification: Poster

Track Classification: Thermochemical treatment (carburizing, carbonitriding, nitrocarburizing, nitriding)