Improvement of High Entropy Nitride Coatings (AlCrNbSiTiMo)N on Mechanical and High Temperature Tribological Properties

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Abstract

(AlCrNbSiTiMo)N coatings were fabricated on both Inconel-718 and Si wafer substrate by Radio Frequency Magnetron Sputtering. In the wear test of (AlCrNbSiTiMo)N coatings investigated by ball-on-disc tribometer at 700℃, the results indicated that the friction coefficient was reduced, owing to the formation of lubricating molybdenum oxide during the wear test. The high temperature tribological performance was highly related to the mechanical properties, the plastic deformation resistance, and the oxide formation during the wear test. The (AlCrNbSiTiMo)N coatings which exhibit outstanding mechanical and tribological characteristics could be a promising candidate for high temperature tribological protective film.

Experimental Procedure

RF reactive sputtering

Experimental Procedure

Results and Discussion

1. Chemical compositions

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<tr>
<th></th>
<th>Al</th>
<th>Cr</th>
<th>Nb</th>
<th>Si</th>
<th>Ti</th>
<th>Mo</th>
<th>N</th>
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2. Films deposited at different substrate bias

- The increase of the compressive stresses at higher substrate bias also contributes to the increase in hardness.
- All the curves go down during the wear test at 700℃, indicating the lubricating effect of the thin films.
- The (ACMSTM)N films deposited at -100 substrate bias exhibit the optimal tribological properties.

Conclusions

- The nitride films of novel multi-components alloy were fabricated at different substrate bias and Mo contents followed by a series of analysis.
- The correlation between the strengthen mechanism, mechanical properties, and high temperature tribological properties is discussed.
- The (ACMSTM)N films deposited at -100 substrate bias with minor Mo doping (0W, 40W) reveal the optimal tribological performance.