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The effect of alloying molybdenum to cathodic arc evaporated Ti-Al-N coatings on their mechanical properties and thermal stability

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Ti1-xAlxN is commonly used as protective coating for, e.g., cutting or forming applications due to its outstanding properties like high mechanical strength and thermal stability. Ever growing demands in process efficiency and precision are in need for application-specific adjustments of already well established coating systems. Thereby, for instance, higher working speeds and increased processing temperatures are accessible. Additional factors determining the coatings' performance during many applications are their tribological behaviour and wear resistance. The addition of molybdenum (Mo), tungsten (W), or vanadium (V), is known to significantly enhance the wear resistance of Ti1-xAlxN.
Here, we study in detail the influence of Mo additions to Ti1-xAlxN coatings on their mechanical properties and thermal stability. The films were prepared by cathodic arc evaporation using powder-metallurgically manufactured (Ti0.5Al0.5)(1-x)Mox targets with Mo contents xof 2, 5, and 10at.%, and applying either -40, -80, and -120 V substrate bias.
The coatings are slightly overstoichiometric with nitrogen contents of about 54 at.%, for all bias potentials used. The ratio of Ti, Al, and Mo within the coatings corresponds to the cathode composition. However, the growth morphology and microstructure of the coatings prepared significantly depend on the Mo content. Our results clearly show that by the addition of Mo not only the hardness of Ti0.5Al0.5N increases but also their thermal stability.

Keywords
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