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Author: Mr. RUTVIK PANDIT
Sapienza University of Rome, Italy, panditrutvik100@gmail.com

Mr. Anirudh Nautiyal
SRM University, kattankulathur, chennai, INDIA, India, anirudhnautiyal123@gmail.com
Dr. Sheela Singh
SRM University, kattankulathur, chennai, INDIA, India, sheela.s@ktr.srmuniv.ac.in
Dr. G.S. Vinod Kumar
SRM University, kattankulathur, chennai, INDIA, India, vinodkumar.s@res.srmuniv.ac.in

STUDIES ON DEVELOPMENT OF NEW COATING MATERIAL FOR SPACE APPLICATIONS.

Abstract

Materials are very important from the very beginning of rocketry. Compared to aircraft gas turbines, rocket engine turbines experience very severe thermal start/ stop transients, high operating speeds, and hydrogen environments which result in the following unique requirements for rocket engine turbine blade materials: high thermal strain low-cycle fatigue strength; high mean stress high-cycle fatigue strength; resistance to hydrogen environment embrittlement; thermal shock resistance; and relatively short time stress-rupture/ creep strength. Failure of the components potentially operating under severe physically stressed conditions results in burning or explosion, which in turn leads to the catastrophic failures.. Although a considerable amount of work has been done in the particular area by coating of the substrate material with different coating compositions such as MCrAlY but a lot is left to be explored. High entropy alloy(HEA) possess good creep strength, excellent oxidation resistance, hot corrosion and wear resistance, high hardness, superior thermal and chemical stability. The present study deals with the Al0.5CoCuCrFeNi high entropy alloy prepared by mechanical activated synthesis and coated on the substrate material by using HVOF (High Velocity Oxygen Fuel) method in order to enhance the overall performance of the shaft in comparison with the conventional one. Presence of the coating is observed to have an increment in the surface hardness by 50% in comparison with the substrate material as measured by the Vicker's hardness apparatus and also an improvement in the hot corrosion resistance of the material. Other properties of the material thus obtained after coating such as chemical stability, wear resistance, density, oxidation etc. can be examined using different testing and experimentation techniques.

Keywords: Failure, High entropy alloy, HVOF (high velocity oxygen fuel)