Effect of surface modifications by abrasive water jet machining and electrophoretic deposition on tribological characterization of Ti6Al4V alloy

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Abstract

Abrasive water jet (AWJ) milling has speedily developed in popularity due to its adaptability and fast production of blind features like channels, pockets etc. But the surface property of AWJ milled samples was found poor restricting the process being commercially used widely. In this work, a two-step methodology has been tried to modify the surface properties of Ti6Al4V substrate, which includes a fast fabrication of miniaturised channel using AWJ technique followed by the electrophoretic deposition (EPD) of Hydroxyapatite-Carbon nanotube (HAp-CNT) coating. The fretting wear test divulges the enhanced wear resistance of synergistically textured Ti6Al4V substrate with EPD HAp-CNT, due to lower coefficient of friction (0.22±0.0) and wear depth (-18.1636 µm) when compared with that of textured Ti6Al4V (0.27±0.005 and -18.8221 µm respectively). The coefficient of friction and wear depth were observed to be highest for bare Ti6Al4V sample (0.41±0.007 and -27.4985 µm respectively). The observed increment in wear resistance is due to the textured channels trapping the wear debris, and decrease in the real contact area due to the coating of HAp-CNT. Thus, fabrication of micro channels by AWJ combined with HAp-CNT coating may provide potential self-lubrication and enhance damage tolerance of Ti6Al4V alloy for biomedical and manufacturing applications.

Recent Publications

1. **Shikha Awasthi**, Jeet Kumar Gaur, and M. S. Bobji, "Advanced Ferrogels with high Magnetic Response and Wear Resistance Using Carbon Nanotubes," **Journal of Alloys and Compounds**, Vol. 848 (2020) pp. 156259-156269.

2. **Shikha Awasthi**, S. K. Pandey, C. P. Pandey and K. Balani, "*Progress in electrochemical and electrophoretic deposition of nickel with carbonaceous allotropes: A Review*," **Advanced Materials Interfaces,** Vol. 7 (2019) pp. 1901096-1901129.

3. **Shikha Awasthi,** S. K Pandey and K. Balani "*Tuning the Magnetism and Tribological Behaviour of Electrodeposited Ni/Cu Bi-layer by Selective Reinforcement of Carbon Nanotubes*" **Journal of Alloys and Compounds,** Vol. 818 (2020) pp. 153287-153299.

4. **Shikha Awasthi**, C. P. Pandey and K. Balani, *"Synergistic role of carbonaceous reinforcements on multi-length scale tribology of electrophoretically deposited nickel-boron nitride coatings,"* **Materials Research Bulletin**, Vol. 99 (2018), pp 61-72.

5. **Shikha Awasthi**, R. Maurya, C. P. Pandey and K. Balani, "*Interfacial mechanics carbonaceous reinforcements in electrophoretically deposited nickel coatings,*" **Surface and Coatings Technology**, Vol. 310 (2017), pp 79-86.

6. **Shikha Awasthi**, V. Pal and S. K. Choudhury, "*Effect of surface modifications by abrasive water jet machining and electrophoretic deposition on tribological characterization of Ti6Al4V alloy,"* **International Journal of Advanced manufacturing Technology** (IF 2.49)**,** Vol. 96 (2018) pp. 1769-1777



Biography

Dr. Shikha Awasthi has her expertise in the coatings technology of various metal/ceramics with carbonaceous reinforcements for aerospace, automotive and biological applications. The emphasis of her research work to impart strengthening and mitigating corrosion and wear damage in metals/biological implants using some carbonaceous (graphene, carbon nanotubes and diamond) and ceramic (hexagonal boron nitride) reinforcements, separately by electrochemical and electrophoretic deposition process. She also bagged ***Best Researcher in Surface Engineering Award and Young Scientist Award*** for her research contributions.

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