Experimental investigation and prediction of tribological properties of titanium carbide and multiwalled carbon nanotubes reinforced aluminium composites using artificial neural network.

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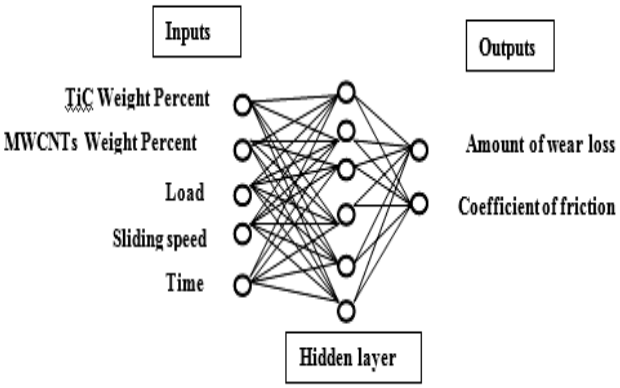
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I. Abstract

In this study, the tribological properties of TiC particle and MWCNTs reinforced aluminium (Al7475) hybrid composite synthesized by stir casting method were investigated by experimental and artificial neural network (ANN) model. Al7475 metal matrix composites was produced with different wt% of TiC and MWCNTs. The composite samples were tested at 0.42 ms^{-1}, 0.84 ms^{-1} and 1.68 ms^{-1} under three different loads (10N, 20N and 40N). The results indicated that Al7475+10%TiC+2%MWCNTs exhibit lower wear rate and coefficient of friction in compare to other samples. TiC percent, MWCNTs percent, applied weight, sliding speed and Time were used as input values for the theoretical prediction model of the composite. Coefficient of friction and Wear loss were the two outputs developed from proposed network. Back propagation neural network with 5 – 6 – 2 architecture that uses Levenberg – Marquardt training algorithm is used to predict the coefficient of friction and wear loss. After comparing experimental and ANNs predicted results it was noted that R^2 was 0.992 for wear loss and 0.980 for coefficient of friction. This indicated that developed predicted model has a high state of reliability.

II. The ANN architecture



III. Reference:

1. Hakan Cetinel, Hasan Ozturk, Erdal Celik and Bekir Karlik, 2006, Artificial neural network based prediction technique for wear loss quantities in Mo coatings, Wear, 261: 1064-1068.
2. Dursun Ozyurek, Ali Kalyon, Musa Yildrium, TanselTuncay and Ibrahim Ciftci, 2014, Exerimental Investigation and prediction of wear properties of Al/SiC metal matrix composites produced by thixomoulding method using Artificial neural network, Materials and Design, 63: 270-277.
3. Adel Mahamood Hassan, Abdalla Alrashdan, Mohammed Hayaneh and Ahmed Turki Mayyas, 2009, Prediction of density, porosity and hardness in aluminium copper based composite materials using artificial neural network, Journal of materials processing technology, 209: 894-899.

IV. Biography:

Dr. Mohamed Zakaulla completed his PhD from visvesvaraya technological university. India. He is currently working as assistant professor in department of mechanical engineering, Kombolcha Institute of Technology, Wollo University, Kombolcha , Ethiopia. He has published more than 12 papers in reputed journals and has participated in 12 international conferences for presenting his work. He is presently a Reviewer for British Journal of Applied Science & Technology and Tribology in Industry.

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