Faculty of Electrical Engineering & Computer Science
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City University of Applied Sciences

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Puneet Rajan

Investigations in Dry Sliding on Modified Surfaces by Laser Surface Technology.

ABSTRACT - Masterthesis

Metal forming is known as one of the most efficient production technique due to its high material utilization. Metal forming is a process where a thin metal sheet is placed between the dies and then the dies are pressed against each other to mold the thin metal sheet into desired shape. The purpose of this study was to employ the laser surface technology to produce metal forming tools surfaces with reduced coefficient of friction and lower wear rate, so that they can be used without using lubricants during the metal forming process.

Firstly, laser remelting process was done on aluminium bronze (CuAl10Ni5Fe4) substrate. Two different processing gases were used during the process, which were argon and compressed air. Compressed air was used to see the effect of oxidizing the particles of the substrate on the properties of laser treated surface of the substrate. One, two and five tracks were remelted to differentiate between the scientific way and practical way of searching the best parameters. The tracks were remelted with three different remelting speeds of 0.4 m/min, 1.0 m/min and 1.6 m/min.

Then laser claddings were done on aluminium bronze (CuAl10Ni5Fe4) and on Cold forming steel (1.2379) with aluminium bronze powder (CuAl10Fe1). Two different grain size powders were used. The cladding speed was varied from 0.5 m/min to 2.0 m/min. A post processing remelting treatment was done on the claddings. Coefficient of friction, wear rate, hardness and geometry of the remelted and cladded tracks were measured. Dry sliding tests were done to measure the COF and wear.

It was concluded from the results that the COP and wear rates values were decreased after treating the substrates with the laser remelting and laser claddings as compared to the respective values of untreated substrates. Lowest COF and wear rate with higher hardness on aluminium bronze substrate was found when it was remelted with the remelting speed of 1.0 m/min.

All the claddings were found out to be strongly adhered to their respective substrate and were free from pores and cracks. Using steel as substrate for cladding gives higher COF with lesser wear rate and lower hardness. Employing aluminium bronze as substrate gives lower COF but higher wear rate with better hardness. Therefore, it can be concluded that better hardness is not directly proportional to better wear

rate. No significant effect of using different grain size powders was concluded. Using bigger sized particle for cladding on aluminium bonze, followed by a remelting treatment shows better hardness results. Lower wear rate for claddings on steel was observed using bigger particle size. The knowledge obtained about the correlation between the cladding process of aluminium bronze on steel 1.2379 and the behaviour in lubricant-free sliding tests is helpful to generate deep drawing tools for dry metal forming in the future.