

Effect of Deep Cryogenic Treatment on Aluminium Alloy Used for Making Heat Exchangers in Automotive HVAC System

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Abstract : In automotive air conditioning system, two heat exchangers are used as evaporator and condenser which are placed inside the bonnet of a car in a compact manner. The dust particles from outside and moisture content produced during the process leads to formation of impure particles on the surface of evaporator coil. But in condenser coil, the impure particles are settling down due to dust from atmosphere. The major problem of the heat exchanger used in automotive air conditioning is leakage of refrigerant due to corrosion. This effect of corrosion will lead to damage on the surface of heat exchanger and leakage of refrigerant from the system. To protect from corrosion, coatings are applied on its surfaces. Nowadays, to improve the corrosion resistance of these heat exchangers, hydrophilic coatings are used, which is very expensive. Cryogenic treatment is one method which involves the treatment of materials below -150 °C using the cryogenic fluid such as liquid nitrogen. In this project work, a study of improvement in corrosion resistance of materials of aluminium alloys of various grades as AA 1100, AA 6061, AA 6063 and AA 2024 that are mainly used for fin and tube heat exchangers in automotive air conditioning system is made. In total, five different processes are selected for these grades of aluminium alloy and various parameters like corrosion rate, dimensional stability, hardness and microstructure are measured. The improvements were observed in these parameters while comparing it with conventional heat treatment process.

Keywords : cryogenic treatment, corrosion resistance, dimensional stability, materials science

Conference Title : ICMSE 2014 : International Conference on Materials Science and Engineering

Conference Location : Amsterdam, Netherlands

Conference Dates : May 15-16, 2014