INTRODUCTION

The aluminium and its alloys are very important material in automotive, transportation and construction due its lightness, resistance against corrosion and good plasticity. In Poland aluminum is only recycled metal and ingots are casting in several foundries. In automotive industry aluminum tubes are used in the air-conditioning construction.

- In the work the structure and properties of different aluminum alloys used to the production of air-conditioning equipment are presented. Two kinds of aluminum tubes ribbed inside are presented. The comparison of usefulness to production of air-conditioning elements of tubes with the ribs elongated to the tube axis and tubes with the screw ribs inside were discussed.
- We started research to use natural refrigerant called R744 - this is CO2. Problem is with higher temperature and higher pressured then present. Our work is first part of research where we check, which currently used materials may be used with CO2.

MATERIALS AND IHX SHAPES IN USE

- Refrigerant R134a/R1234yf
  - AA 3xxx
  - AA 5xxx
  - AA 6xxx

- Refrigerant R744
  - AA 2xxx

STRAIGHT IHX

TWISTED IHX (PATENTED)

MATERIALS AND IHX SHAPES IN FUTURE (STUDIED)

- Selection of Materials
  - Preparing specimen
  - Annealing at -25°C, 25°C, 40°C, 60°C, 80°C, 100°C, 140°C, 180°C and 220°C for 72 hours and 240 hours and then water cooled
  - Vickers microhardness
  - Light microscopy (LM)

RESULTS

- AA 6060 after annealing
  - Structure of AA6060 after annealing for 72h at -25°C
  - Structure of AA6060 after annealing for 72h at 80°C
  - Structure of AA6060 after annealing for 72h at 220°C

- AA 3103 after annealing
  - Structure of AA3103 after annealing for 72h at -25°C
  - Structure of AA3103 after annealing for 72h at 80°C
  - Structure of AA3103 after annealing for 72h at 22°C

CONCLUSIONS

- The presented investigation results indicated that Aluminium Alloys 3031 don’t change level of microhardness during annealing in the range of -25°C - 220°C.
- Alloy 6060 showed some changes in microhardness after annealing at the temperature above 140°C.
- The literature data indicated that changes of microhardness 6060 alloys are connected with the precipitation process of intermetallic phases.
- All investigated alloys are useful in automotive products, but not for all pipes.
- AA6060 can’t be used as “B” pipes
- The refrigerant flowing through the countercurrent IHX exchanger should be treated as a compressible actual fluid
- The design and estimated values of the boundary conditions for the flow of refrigerant R744 in the exchanger indicate the presence of supercritical fluid flow in the high pressure internal tube.
- The refrigerant effect is higher in the twisted IHX than in the straight IHX, so the use in automotive air conditioning with R744 (CO2) is recommended.

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