AN EXPERIMENTAL STUDY ON THE DEFORMATION BEHAVIOUR AND FRACTURE MODE OF RECYCLED ALUMINIUM ALLOY AA6061 REINFORCED ALUMINA OXIDE UNDERGOING HIGH-VELOCITY IMPACT

ENERGY COSTLY

The production of primary aluminum is an energy costly process, involving various manufacturing processes

Climate change impacts and Greenhouse Gas (GHG) emission

ENVIRONMENTAL CONCERN

BENEFITS OF RECYCLING ALUMINIUM

ENVIRONMENT

- **Energy Saving**: The remelting of recycled aluminum saves almost 95% of the energy required to manufacture pure aluminum from bauxite ore. 113 GJ energy to produce one tonne primary aluminium, 13.6 GJ per tonne to produce aluminum from scrap
- **Reduced Solid Waste Disposal**: The mass of solid waste generated per tonne of secondary aluminum is 90% lower than that of primary aluminium
- **Reduced GHG Emissions:** The amount of GHG emission is reduced by more than 95% when aluminum is produced by recycling rather than primary processes

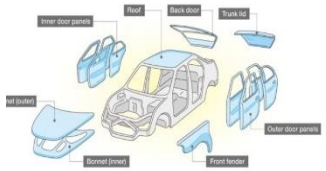
ECONOMY

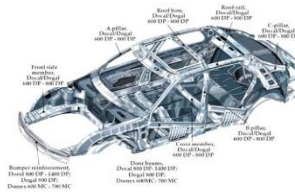
- **Renewable Source**: Reduction of dependence upon overseas sources.
- **Recycling Industry**: Create more jobs
- **Recycling Technology**: To automate and optimize pre-sorting, cleaning, shredding, and separation process, and to make them broadly available

"For each 1% increase in the amount of aluminum cans recycled, the economic savings to the U.S. economy is $12 million/year"

DP STEELS APPLICATION

Based on their High energy absorption capacity and fatigue strength, rolled dual-phase steels are particularly well suited for automotive structural and safety parts such as longitudinal beams, cross members and reinforcements.

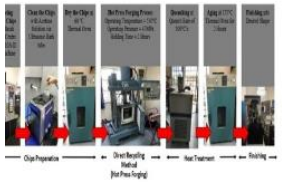




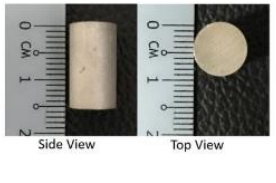
High formability type alloys are recommended where the formability is regarded as critical including high strength and dent resistance

SECONDARY ALUMINIUM 6 SERIE DREAM APPLICATION

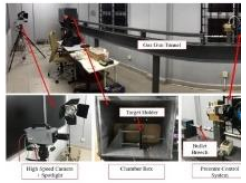
TAYLOR CYLINDER IMPACT TEST



SPECIMENS PREPARATION



CYLINDRICAL SPECIMEN



GAS GUN MACHINE

EXPERIMENTAL CONCLUSIONS

CRITICAL IMPACT VELOCITY

Below 280 m/s

STRAIN RATE

Strong strain rate dependency due to the damage evolution that is increasing with the increment of the impact velocity cause to severe localized plastic strain deformation

DUCTILITY

Remained ductile

FRACTURE MODE

Ductile fracture behaviour:
Mushrooming shape
Tensile splitting
Petalling

ANISOTROPY

Remained anisotropy - non-symmetric ellipse-shaped of the footprint

DAMAGE DEVELOPMENT

Voids nucleation, growth and coalescence
Crack

Taylor Impact Test is used to investigate the anisotropic behaviour, and the damage evolution of recycled aluminium alloy reinforced alumina oxide (Al_2O_3). The test is performed at various impact velocity range from 190 m/s to 360 m/s are mushrooming, tensile splitting and petalling. The critical impact velocity of such recycled material is defined lower than 280 m/s. The specimens showed a strong strain rate dependency due to the damage evolution due to severe localized plastic strain deformation. The Scanning Electron Microscope (SEM) analysis showed the damage mechanism progress via voids initiation, growth and coalescence in the material. The damage is propagated from the impact surface toward the top end of the material. The micrograph within the footprint surface shows the presence of Al_2O_3 particles within the specimen. The microstructure analysis shows a significant refinement of the specimen particle at the surface located 0.5 cm above the impact area.