THE PRELIMARIES STUDIES ON RECYCLED ALUMINIUM FROM AUTOMOTIVE COMPONENT

BUREAU OF RESEARCH AND CONSULTANCY
UNIVERSITI TEKNOLOGI MARA
40450 SHAH ALAM, SELANGOR
MALAYSIA

PREPARED BY

MAZLEE MOHD NOOR

DR. ABDUL HALIM ZULKIFLI

DR. SHAMSUL BAHARIN JAMALUDIN

SHARIZAL HASAN

APRIL 2003

PENGHARGAAN

Setinggi-tinggi penghargaan dan ribuan terima kasih diucapkan kepada semua pihak yang terlibat secara langsung atau tidak bagi membolehkan projek penyelikan ini disiapkan dengan jaya dan sempurnanya,

Profesor Datuk Dr. Ibrahim Bin Abu Shah
Naib Canselor, Universiti Teknologi MARA
Shah Alam, Selangor

Profesor Madya Dr. Ahmad Redzuan Bin Abd Rahman
Pengarah, UiTM Kampus Arau, Perlis

Profesor Azni Binti Zain
Ketua, Biro Penyelidikan dan Perundingan
UiTM Shah Alam, Selangor

Profesor Madya Dr. Mahadzir Hj. Din
Ketua, Biro Penyelidikan dan Perundingan
UiTM Kampus Arau, Perlis

Serta,
Semua pensyarah dan orang perseorangan yang telah sudi dan bersedia memberi bantuan serta buah fikiran.

CONTENTS

ABSTRACT

The research has been carried out using recycled diesel (denoted as Alloy A) and petrol (denoted as Alloy B) aluminium cylinder heads respectively. Sand casting route has been employed to fabricate the specimens. Five specimens have been cast were 100% Alloy A (specimen V), 100% Alloy B (specimen W), 50% Alloy A : 50% Alloy B (specimen X), 70% Alloy A : 30% Alloy B (specimen Y) and 30% Alloy A : 70% Alloy B (specimen Z). Light microscope was used to identify and analyse the microstructure of as-cast alloys. Keller's reagent was used as an etchant in order to reveal the microstructure of the alloys. It has been noted that large dendritic cells were resulted from slow cooling in sand mould. The irregular arrangements of grain boundaries were due to the unmodified process. Typical microstructure has been observed was eutectic aluminium with intermetallics such as Mg_2Si, $FeSiAl_5$ needles and Chinese script particles $(Fe,Mn)_3Si_2Al_{15}$. Less concentrated $FeSiAl_5$ needles along the grain boundaries had contributed to a higher tensile strength property.

For scanning electron microscopy morphology observation, two specimens have been chosen were 100% Alloy B (specimen W) and 30% Alloy A : 70% Alloy B (specimen Z). Both specimens have fractured by tensile test. Specimen W has a higher tensile strength compared to specimen Z. The fracture surface was studied using scanning electron microscope (Leica Cambridge S360 model) in order to characterise the fracture behaviour of the alloys. It was found that specimen W showed the ductile behaviour which exhibited void formations, dimples and shear fractures whereas specimen Z showed the brittle behaviour such as cleavage fractures.

CHAPTER 1

INTRODUCTION

Aluminium is the most abundant metallic element in the earth's crust but always occur in the combined state with other elements such as iron, silicon and oxygen. Bauxite that is mainly hydrated aluminium oxide is the main mineral used for the production of aluminium. Pure aluminium oxide is extracted from bauxite by the Bayer process (Smith, 1993).

The rapid growth of the aluminium industry is attributed to a unique combination of properties that makes it as one of the most versatile of engineering and construction materials. Aluminium possesses a combination of properties which make it extremely useful engineering materials. Aluminium has a low density (2.70 g/cm^3) making it particularly useful for transportation manufactured products. Aluminium also has good corrosion resistance in most natural environments due to the tenacious oxide film which forms on its surface. Although pure aluminium has low strength, it can be alloyed to strength of about 690 MPa. Aluminium also is a nontoxic and used extensively for food containers and packaging. The good electrical properties of aluminium make it suitable for many applications in the electrical industry.

The development of the aerospace industry during the twentieth century has relied heavily on the availability of aluminium and its alloys. Since their introduction into Zeppelins during World War I and both civil and military aircraft since World