REFINING OF THE RRIM PROCESS, MATERIALS AND EQUIPMENT IN THE AUTOMOTIVE INDUSTRY

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INTRODUCTION

United States automobile manufacturers are faced with the problem of providing a sufficient proportion of five- and six-passenger cars to satisfy the needs of American families while meeting the requirement for maximum fuel economy dictated by Federal regulations and the rapidly escalating cost of gasoline.

Part of the solution lies in new technologies, such as Ford Motor Company's automatic overdrive transmission and electronic engine controls, along with downsizing to provide cars that are smaller on the outside, but which retain usable passenger space. However, the total solution requires the substitution of lightweight materials, which can hold to a minimum the need to downsize.

The major lightweight materials involved in weight reduction will be: high strength steel, aluminum, thin glass and plastics. Exterior body panels are a natural target for weight reduction because they represent a significant portion of the total vehicle weight.

Recent efforts have been concentrated on development of RRIM technology to be used for exterior body panels. The materials need to have these key physical properties: (1) automotive Class "A" surface finish, (2) acceptable heat stability in car position while being processed through assembly plant ovens up to four times at 285°F - 300°F surface temperatures, (3) the material's heat stability combined with good impact properties at 72°F and -20°F, (4) material stability that assumes no permanent cumulative expansion or contraction will occur when other production steps are taken, (5) capability

J. E. Kresta (ed.), Reaction Injection Molding and Fast Polymerization Reactions
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to be painted with standard body enamel paint in car position.

I want to stress that this paper exclusively discusses the requirements for urethane or non-urethane RRIM materials for the on-line painting process (higher paint curing temperature) rather than the off-line painting process. The materials for off-line painting process (lower paint curing temperature) are here and are being used by the industry.

The requirements for the on-line painting are more difficult to obtain with polyurethane, therefore, non-urethanes are being investigated.

This presentation is centered around refinements of the RRIM material, process and equipment development. It is based on my paper "RRIM - A New Process in the Automotive Industry." The rate of RRIM development becomes obvious with a comparison of these two papers.

RIM + RRIM - THEIR POSITION IN THE AUTOMOTIVE INDUSTRY

The RIM process is not new to the automotive industry. Mustang and Capri carlines have front and rear fascias produced with low modulus RIM polyurethane. Off-line part painting is employed.

A new challenge is to produce large exterior parts painted with the car bodies on assembly lines to eliminate the investment cost for off-line painting systems and to insure good color match between the plastic and steel body parts. This challenge leads to the new technique called RRIM. The RRIM process consists of adding a filler to the polymer to increase its heat stability, stiffness and coefficient of linear thermal expansion (CTE) in comparison to the RIM process. The addition of the abrasive filler to material tanks brings about a need for process, equipment and filler development. Each of these will be discussed individually.

RIM + RRIM - ENERGY CONSERVING PROCESSES

Conservation of energy is becoming more and more important not only for consumers but also for the automotive industry in general.

The RRIM process is competing with the metal stamping and SMC processes in the area of exterior body panels. One must consider the energy aspect of a new process and compare it with well-established processes. It is expected that energy consumption will play a significant role when new production facilities are planned. The needed energy can be divided into two categories: energy of the feed stock the part is made from, and energy from the fuel required to process the part. Metal materials do not have an energy content