Rubber Processing Technology

Introduction

Production of rubber goods can be divided into two principal steps:

1. Production of the rubber
2. Processing of the rubber into finished good

The manufacturing processes for rubber production are beyond the scope of the present text. Interested readers should refer to more specialized books for a detailed coverage of this problem.

Processing of rubber into finished good

The process sequence includes the following principal operations:

1. Compounding
2. Mixing
3. Shaping
4. Vulcanizing

Compounding

The purpose of compounding is to add chemicals (sulphur) for vulcanization to the rubber. Other additives are filling materials to enhance the mechanical properties (carbon black), antioxidants, ozone-protective chemicals, coloring pigments, et al. Additives are mixed with the base material during the next step, mixing.

Mixing

The process of mixing is accomplished in two phases to avoid premature vulcanization:

1. Mixing all non-vulcanizing additives
2. Mixing sulphur additive

The figure illustrates the equipment used for mixing:

(a) two-roll mill, and (b) internal mixer
Shaping processes

Extrusion

The extrusion process for rubber is the same as for polymers.

Calendering

Calendering is a process for producing sheet and film stocks out of rubber or thermoplastics. Extrusion and calendering can be combined in the roller die process.

Coating

This process involves coating of rubber onto substrate fabrics:

Other processes than calendering can also be utilized for coating.

Molding and casting

The process setup is the same as for the other materials. A special process for rubber is so-called dip casting, in which a mold is submersed in a liquid polymer for certain duration. Dipping may be repeated to form the desired thickness. Coating is then stripped from the form and cured.

Vulcanization

Vulcanization is a treatment for rubber to become stiffer and stronger. The process involves the use of sulphur at a temperature of 140°C for about 5 hr.; time enough to accomplish cross-linking of elastomers molecules.