Rubber processing and compounding refer to the process of transforming natural or synthetic rubber into various usable products, such as tyres, rubber seals, belts, and hoses. The rubber processing industry encompasses various methods of transforming raw rubber into useful products, which include blending, mixing, extrusion, molding, and curing.

Rubber compounding involves the addition of various additives, such as carbon black, antioxidants, curing agents, plasticizers, and other chemicals, to modify the physical and mechanical properties of the rubber. Compounding ingredients and techniques vary according to the end-use application and the desired properties of the final product. Rubber compounds are widely used in various industries, including automotive, construction, electrical, and healthcare. The unique properties of rubber compounds, such as durability, flexibility, and resistance to heat and chemicals, make them ideal for various applications.

The market for rubber processing and compounding is positive, with increasing demand for high-performance and environmentally sustainable rubber products. Key trends driving this growth include a growing demand for electric vehicles, advancements in tyre technology, and increased demand for rubber products in emerging markets.

The market is expected to grow at a steady rate in the coming years, with a compound annual growth rate (CAGR) of 5.3%. This growth can be attributed to the rising demand for high-performance and eco-friendly rubber products. The increasing demand for rubber processing and compounding services in the Asia-Pacific region is one of the primary drivers of the market growth. China and India are the key markets in the region, with high growth potential due to the growing automotive industry and government initiatives promoting the use of eco-friendly materials. Moreover, the increasing demand for tyres, rubber seals, gaskets, and hoses, coupled with advancements in the manufacturing process, is driving the growth of the market. Another trend driving the market is the growing focus on sustainability and reducing the carbon footprint. Many companies are investing in research and development to develop sustainable rubber products. The rubber processing and compounding industry is witnessing rapid growth in recent years. With the increasing demand for rubber products across various industries such as automotive, construction, healthcare, and electronics, the market outlook for this industry looks promising.


A total guide to manufacturing and entrepreneurial success in today’s most demandable rubber processing
and compounding industry. This book is one-stop guide to one of the fastest growing sectors of the rubber processing and compounding industry, where opportunities abound for manufacturers, retailers, and entrepreneurs. This is the only complete handbook on the commercial production of rubber. It serves up a feast of how-to information, from concept to purchasing equipment.

Contents

1. Introduction
   1.1. Rubber Applications
   1.2. Types of Rubber
       1.2.1. Natural Rubber
       1.2.2. Synthetic Rubber
   1.3. Production of Synthetic Rubber
   1.4. Market of Rubber
2. Mixing Technology of Rubber
   2.1. Introduction
   2.2. Mixing Machinery for Rubber
       2.2.1. Two-roll Mills
       2.2.2. Internal Batch Mixers
       2.2.3. Continuous Mixers
       2.2.4. Development of the Banbury Mixer
       2.2.5. Operating Variables
   2.3. Mixing Cycles and Procedures
       2.3.1. Unit Operations in Mixing
       2.3.2. Single-Pass Versus Multiple-Pass Mixing
       2.3.3. Types of Mix Cycle
       2.3.4. Analysis of Changes to the Mix Procedure
   2.4. Mill Mixing
       2.4.1. Acceleration of First-pass Compound
       2.4.2. Mill Mixing of Speciality Compounds
       2.4.3. Acceleration in Line with Internal Mixing
   2.5. Quality Control And The Mixing Process
       2.5.1. Testing of Raw Materials
       2.5.2. Elastomers as Raw Materials
       2.5.3. Control of Composition
       2.5.4. Tracking the Mix Cycle
       2.5.5. Compound Testing
   2.6. Statistical Process Control For Industrial Mixing
       2.6.1. Basic SPC Charting
       2.6.2. Rheometer Data and its Meaning
       2.6.3. Mixing Control Software
   2.7. Additives that Affect Mixing
       2.7.1. Peptisers in Natural Rubber
       2.7.2. Peptisers in SBR
       2.7.3. Peptisers in Sulphur-containing Polymers
       2.7.4. Additives to Increase Viscosity
       2.7.5. Preventing Unwanted Chemical Reactions
   2.8. Operation and Maintenance of Mixing Equipment
       2.8.1. Inspection of Banbury Mixers
       2.8.2. Inspection at the Mezzanine Level
       2.8.3. Inspection of the Banbury Platform
2.14.1. Farrel Continuous Mixer
2.14.2. Operating Principles of the FCM
2.14.3. Commercial Applications for the FCM
2.14.4. Farrel Mixing Venting Extruder (MVX)

2.15. Evaluating the Performance of Internal Mixers
2.15.1. Designing the Rotor
2.15.2 Analysis of Dispersive Mixing

3. Techniques of Vulcanization
3.1. Introduction
3.1.1. Pressureless Vulcanization
3.2. Pressurized Vulcanization
3.2.1. Rubber Moulding
3.2.2. Factors of Moulding
3.2.3. Moulding
3.2.4. Compression Moulding
3.2.5. Transfer Moulding
3.2.6. Injection Moulding
3.3. Mould Shrinkage
3.4. Moulding Defects
3.5. Pressurized Liquid Continuous Vulcanization
3.6. High-Velocity Gas Cure
3.6.1. Helicure
3.7. Finishing
3.8. Recycling of Vulcanized Rubber Products
3.8.1. Buffed Tread Crumb
3.8.2. Incineration and Pyrolysis of Tyres
3.8.3. Reclaimed Rubber

4. Rubber Vulcanization
4.1. Vulcanization And Its Effects
4.2. Vulcanization Reaction Stages
4.3. Vulcanization of Thick Rubber Articles
4.4. Determination of State of Vulcanization
4.4.1. Physical Property Tests
4.4.2. Free Sulphur Determination
4.4.3. Solvent-swell Method
4.4.4. Mooney-Rivlin Equilibrium Modulus
4.4.5. Differential Scanning Calorimetry
4.4.6. Determination of Spring Constant
4.5. Vulcanization Systems
4.5.1. Sulphur Vulcanization
4.6. Overall Course of Accelerated Sulphur Vulcanization
4.6.1. Peroxide Crosslinking
4.6.2. Resin Vulcanization
4.6.3. Electron Beam Vulcanization
4.6.4. Nitroso Compounds
4.6.5. Metal Oxides

5. Rubber Compounding
5.1. Introduction
5.1.1. General Compounding Principles
5.2. Vulcanize Physical Properties and their Significance
5.2.1. Tensile Strength
5.2.2. Tear Resistance
5.2.3. The Crescent Tear Test
5.2.4. The Hardness of Rubber
5.2.5. Set
5.2.6. Abrasion Resistance
5.2.7. Flex Cracking Resistance
5.2.8. Resilience
5.2.9. Heat Build-up
5.2.10. Temperature Resistance
5.3. Compound Properties Desired for Different Rubber Compounds
5.3.1. Tyres
5.3.2. Retreading Materials
5.3.3. Conveyor Belt, Transmission Belting and Hose
5.3.4. Footwear
5.3.5. Rubber Roller
5.3.6. Medical Applications
5.3.7. ’O’ rings and Seals
5.4. Compounding Ingredients
5.4.1. Rubber Blends
5.4.2. Master Batches
5.4.3. Choice of Rubber
5.4.4. Fillers
5.4.5. Vulcanizing Agents
5.4.6. Peptizers
5.4.7. Accelerators
5.4.8. Activators
5.4.9. Anti-oxidants
5.4.10. Retarders
5.4.11. Softeners and Plasticizers
5.4.12. Rubber Crumb
5.4.13. Factice
5.4.14. Processing Aids
5.4.15. Special Purpose Additives
5.5. Basic Compound Formulations
5.5.1. Unvulcanized compound properties
5.5.2. Vulcanized compound properties
6. Rubber Gloves Manufacturing
6.1 Synthetic rubber gloves
6.1.1. Nitrile gloves
6.1.2. Vinyl gloves
6.2. Use of Rubber Gloves
6.2.1. Medical Use
6.2.2. Food Preparation
6.2.3. Cleaning
6.2.4. Salons & Spas
6.2.5. Automotive Work
6.2.6. Construction
6.2.7. Security & Police Investigations
6.2.8. Laboratories
6.2.9. Gardening & Outdoor Work
6.2.10. Child Care
6.3. Can Reuse Rubber Gloves?
6.3.1. Reusable
6.3.2. Disposable
6.4. Glove Manufacturing Process
6.4.1. Latex Collection
6.4.2. Coagulant Dipping
6.4.3. Drying
6.4.4. Latex Dipping
6.4.5. Leaching
6.4.6. Beading
6.4.7. Vulcanization
6.4.8. Post Leaching
6.4.9. Slurry Dipping
6.4.10. Stripping
6.4.11. Tumbling
6.4.12. Quality Control
6.4.13. Packing
7. Condoms Manufacturing
7.1. History
7.2. Manufacturing process
7.2.1. Collecting the raw materials
7.2.2. Compounding
7.2.3. Storage
7.2.4. Dipping
7.2.5. Tumbling
7.2.6. Condom Testing Procedures
7.2.6. Packaging
7.2.7. Packaging for Retail
7.2.8. The finished product
8. Rubber Band Manufacturing
8.1. Rubber Band Dimensions and Measuring
8.2. Sizes
8.3. Rubber Types Used in Rubber Bands
8.4. Rubber Band Uses
8.5. Applications of Rubber Bands
8.6. The Manufacturing Process
8.6.1. Processing the natural latex
8.6.2. Mixing and milling
8.6.3. Extrusion
8.6.4. Curing
8.6.5. Quality Control
9. Latex Mattress Manufacturing
9.1. Types of Latex
9.2. Benefits of a Latex Mattress
9.3. Manufacturing Process
9.3.1. Collecting the Raw Material
9.3.2. Processing of Liquid Latex
9.3.3. Forming the latex foam
9.3.4. Inspect the Latex Foam Layers for Quality
9.3.5. Finishing the Latex Foam with Fine Details
9.3.6. Covering the Latex Foam with Fabric
10. Rubber Bushings Production
10.1. Rubbers Used in Rubber Bushing Manufacture
10.1.1. Natural Rubber
10.1.2. Styrene Butadiene Rubber (SBR)
10.1.3. Nitrile Butadiene Rubber (NBR)
10.1.4. Silicone Rubber
10.1.5. Ethylene Propylene Diene Monomer (EPDM)
10.2. Uses of Rubber Bushings
10.2.1. Automotive Manufacturing
10.2.2. Rubber Bushings in Skateboards
10.2.3. Shock Bushings
10.2.4. Tank Bushing
10.2.5. Bushings in Fans
10.3. How are Bushings Made?
10.4. Extrusion Procedure
10.4.1. Raw Rubber Compound
10.4.2. Feed Hopper
10.4.3. Extruding the Rubber Compound
10.4.4. Hot and Cold Feed Extrusion
10.4.5. Vulcanization Process
10.4.6. In Line Curing and Off Line Curing
11. Rubber Gasket Manufacturing
11.1. Industrial Applications of Rubber Gaskets
11.1.1. Pipe Fittings and Industrial Piping
11.1.2. Plumbing and Water Utility
11.1.3. Automotive
11.1.4. Aerospace
11.1.5. Marine
11.1.6. Tanks, Vessels, and Containers
11.1.7. Manufacturing of Food and Drugs
11.2. Manufacturing Process
11.2.1. Die-Cutting
11.2.2. Water Jet Cutting
11.2.3. Laser Cutting
11.2.4. Flash Cutting
11.2.5. Injection Molding
11.2.6. Extrusion of Rubber Gaskets
11.3. Processes of Vulcanization
11.3.1. Steam Curing
11.3.2. Continuous Curing
11.3.3. Hot Splicing
12. Rubber Sheets Manufacturing
12.1. Benefits of Rubber Sheets
12.2. Types of Rubber Sheets
12.2.1. Natural Rubber Sheets
12.2.2. Neoprene Rubber Sheets
12.2.3. Nitrile Rubber Sheets
12.2.4. Hydrogenated Nitrile (HNBR)
12.2.5. Rubber Ethylene Propylene (EPDM Rubber Sheets)
12.2.6. Silicone Rubber Sheets
12.2.7. Fabric Reinforced Rubber Sheets
12.2.8. Styrene-Butadiene Rubber (SBR) Sheet
12.2.9. Viton Sheets
12.2.10. Butyl (IIR)
12.3. Rubber Sheet Materials
12.3.1. Thermoplastic Polymers
12.3.2. Thermoset Polymers
12.3.3. Rubbers in Rubber Sheets
12.3.4. Compounding Ingredients
12.4. Manufacturing Process of Rubber Sheets
12.4.1. Molding
12.4.2. Extrusion
12.4.3. Latex Dipping
12.4.4. Calendering
12.4.5. Rubber Sheet Joining
13. Rubber Tubing and Its Manufacturing
13.1. Rubber Materials Used in the Production of Rubber Tubing
13.2. Types of Rubber Materials
13.2.1. Fluoroelastomer Rubber Tubing (FKM or Viton™)
13.2.2. Butyl Rubber Tubing
13.2.3. Hypalon Rubber Tubing (Chloro sulfonated Polyethylene of CSM)
13.2.4. Natural Rubber Tubing (NR)
13.2.5. Neoprene Rubber Tubing (Polyisoprene)
13.2.6. Nitrile Rubber Tubing
13.2.7. Styrene Butadiene Tubing (SBR)
13.2.8. Silicone Rubber Tubing
13.2.9. Thermoplastic Rubber Tubing (TPE)
13.2.10. Ethylene Propylene Diene Monomer Rubber Tubing (EPDM)
13.2.11. Hytrel® Rubber Tubing
13.3. Types of Rubber Tubing
13.3.1. Food Grade Rubber Tubing
13.3.2. Medical Grade Rubber Tubing
13.3.3. Conductive Rubber Tubing
13.3.4. Microbore Rubber Tubing
13.3.5. Air Rubber Tubing
13.3.6. Chemical Rubber Tubing
13.3.7. Heat Shrink Rubber Tubing
13.3.8. Fabric Reinforced
13.3.9. Non-Reinforced Rubber Tubing
13.4. Industries that Use Rubber Tubing
13.4.1. Automotive
13.4.2. Agriculture
13.4.3. Aerospace
13.4.4. Food Processing
13.4.5. Marine
13.4.6. Medical and Pharmaceutical
13.5. Manufacturing Process
13.6. Mandrel Process
13.6.1. Rubber Roll
13.6.2. Milling
13.6.3. Cutting
13.6.4. Mandrel
13.6.5. Reinforcement Layer
13.6.6. Final Layer
13.6.7. Taping
13.6.8. Vulcanization
13.6.9. Removing from the Mandrel
13.7. Extrusion Method
13.7.1. Feeding
13.7.2. Revolving Screw
13.7.3. Rubber Tubing Die
13.7.4. Vulcanization

14. Tyre Manufacturing Process
14.1. The Parts of a Tyre
14.1.1. Beads
14.1.2. Belt
14.1.3. Ply
14.1.4. Sidewall
14.1.5. Sipe and Groove
14.1.6. Shoulder
14.1.7. Tread
14.2. Raw Materials
14.3. Production Process
14.3.1. Body, beads, and tread
14.3.2. Tyre-building machine
14.3.3. Curing

15. Waste Tyre Recycling Process
15.1. Application of Recycling Waste Rubber
15.2. Benefits of Tyre Recycling
15.2.1. Creates New Products
15.2.2. Reduces Volume of Tyre on Landfill Space
15.2.3. Helps to Prevent Diseases
15.2.4. Prevents Fires and Pollution
15.3. Pyrolysis Process for Waste Rubber Tyre Recycling
15.4. Application of Products Derived From Pyrolysis Process
15.5. Process of Tyre Recycling
15.5.1. Collection of Waste Tyres
15.5.2. Tyre Processing (Shredding)
15.5.3. Steel Liberation
15.5.4. Screening Stage
15.5.5. Cleaning Stage
15.5.6. Packaging and Transporting Stage

16. Hoses Manufacturing
16.1. Design of Hoses
16.2. Hose Manufacture
16.3. Braided/Spiralled Hoses

17. Conveyor Belt Production
17.1. Parts of a Conveyor Belt
17.1.1. Strength member
17.1.2. Inter ply rubber
17.1.3. Cover rubber
17.1.4. Breaker
17.2. Manufacturing Process
17.2.1. Fabric preparation
17.2.2. Preparation of cover rubber
17.2.3. Slitting of plies
17.2.4. Raw belt making
17.2.5. Vulcanization
17.2.6. Inspection and repair
17.2.7. Finished belt testing
17.2.8. Belt grade
17.3. PVC Belting
17.4. Steel Cord Belting
17.5. Advantages of steel cord belting
18. Latex and Foam Rubber
18.1. Introduction
18.2. Products From Latex
18.2.1. Selection of Raw Materials
18.2.2. Preparation of Raw Materials
18.2.3. Compounding and Design
18.2.4. Maturation
18.2.5. Processing and shaping
18.2.6. Dipped Goods
18.2.7. Latex Thread
18.2.8. Vulcanisation
18.2.9. Hot Air Cure
18.2.10. Hot Water Vulcanisation
18.2.11. Autoclave Vulcanisation
18.2.12. Radiation Vulcanisation
18.2.13. Ultrasonic Wave Curing
18.2.14. Testing of Rubber Products
18.2.15. Packing and Marketing
18.2.16. Conclusions and Recommendations
18.3. Latex Foam
18.3.1. Manufacture of Latex Foam
18.3.2. Dunlop Process
18.3.3. Mechanism of Gelling
18.3.4. Compounding
18.3.5. Foaming and Gelling
18.3.6. Construction of Moulds
18.3.7. Curing
18.3.8. Washing
18.3.9. Drying
18.3.10. Finishing
18.4. Common Defects in Foam Making
18.4.1. Shrinkage
18.4.2. Foam Collapse
18.4.3. Setting
18.4.4. Complete Distortion of the Foam
18.5. Estimation of Protein Contamination in Latex
18.5.1. Protein estimation protocol
18.5.2. Conclusion
19. Silicone Rubber
19.1 Introduction
19.2. Types of Silicone Rubber
19.2.1. Electronics and Electrical Industries
19.2.2. Silicone Rubbers to Mimic Flesh
19.3. Synthesis Of Silicone Polymers
19.4. Vulcanisation
19.5. Compounding Ingredients
19.5.1. Silicone Polymers
19.5.2. Silicone Rubber Elastomers
19.5.3. Reinforcing Fillers
19.5.4. Semireinforcing or Extending Fillers
19.5.5. Additives
19.5.6. Curing Agents
19.6. Compounding
19.6.1. Mixing
19.7. Fabricating
19.7.1. Freshening
19.7.2. Moulding
19.7.3. Extrusion
19.7.4. Calendering
19.7.5. Dispersion Coating of Fabric
19.7.6. Heavy-duty Hose
19.7.7. Bonding
19.7.8. Bonding Unvulcanised Silicone Rubber
19.7.9. Bonding Vulcanised Silicone Rubber
19.7.10. Post-baking
19.8. Liquid Silicone Rubber Compounds
19.8.1. Condensation Cure—One-component
19.8.2. Condensation Cure—Two-component
19.8.3. Addition Cure
19.9. Relation Between Properties of Crude and Cured Silicone Compounds
20. Reclaimed Rubber
20.1. Introduction
20.2. Types of Reclaim
20.2.1. Whole Tyre Reclaim
20.2.2. Minimum Staining Reclaim
20.2.3. Drab and Coloured Reclaims
20.2.4. Butyl Reclaim
20.3. Evolution of Reclaiming Processes
20.4. Reclaiming Processes
20.4.1. Scrap-rubber Preparation
20.4.2. Reclaimed Rubber
20.4.3. Digester Process
20.4.4. Reclamator Process
20.4.5. Pan Process
20.4.6. Engelke Process
20.4.7. Testing and Evaluations of Reclaimed Rubber
20.5. Dynamic Devulcanisation
20.5.1. Millroom Operations
20.6. The Advantages of Using Reclaimed Rubber
20.6.1. Special Strengths Through Reclaiming
20.6.2. Further Advantages of Reclaiming—Applications
20.6.3. Major Uses of Reclaimed Rubber
20.7. Rubberised Asphalt
20.7.1. Applications
20.8. Reclamation of Waste Rubber from Latex Based Rubber Industries
20.8.1. Process
20.8.2. Characterisation of Reclaimed Waste Latex Rubber (WLR)
21. Rubber Natural
21.1. Agriculture
21.2. Exploitation
21.3. Latex Composition
21.4. Types and Grades
21.5. Production
21.6. Latex Concentrate
21.7. Processing
21.8. Chemistry
21.9. Physical Properties
21.10. Economic Aspects
21.11. Applications

22. Flow Diagram and Factory Layout
23. Photographs of Plant and Machinery with Suppliers Contact Details

- Waste Tyre Recycling Machine
- Glove Making Machine
- Auto Latex Condom Making Machine
- Rubber Open Mixing Mill
- Automatic Rubber Sheeting Machine
- Rubber Bands Cutting Machine
- Rubber Gasket Cutting Machine
- Rubber Hose Machine
- Rubber Tire Crusher Machine
- Tyre Cutter
- Rubber Dispersion Kneaders
- Fully Automatic Rubber Bale Cutter
- Rubber Calender Machine
- Tyre Block Cutter
- Rubber Extruder
- Tyre Shredder Machine
- Hydraulic Presses
- Tyre Building Machine
- Cold Feeding Extruder
- Tyre Building Machine
- Rubber Bushing Making Machine
- Rubber Vulcaniser
- Tyre Strip Cutting Machine
- Mixing Mills
- Compression Moulding Press
- Tyre Ring Cutter
- Rubber Tube Making Machine
- Tyre Strip Cutter
- Rubber Refiner Mill
- Injection Moulding
- Cyclone Separator
- Banbury Mixer
- Tyre Re-Treading Machine
- Granulator
- Stripping Column

About NIIR
NIIR PROJECT CONSULTANCY SERVICES (NPCS) is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.


NPCS also publishes varies process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.