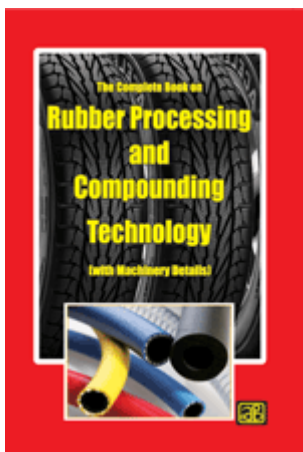


# The Complete Book on Rubber Processing and Compounding Technology (with Machinery Details) 2nd Revised Edition



**Author:** NIIR Board of Consultants and Engineers

**Format:** Paperback

**ISBN:** 9788178331621

**Code:** NI174

**Pages:** 680

**Price:** Rs. 1,875.00 **US\$** 150.00

**Publisher:** Asia Pacific Business Press Inc.

Usually ships within **5** days

The production of rubber and rubber products is a large and diverse industry. The rubber product manufacturing industry is basically divided into two major sectors: tyre and non-tyre. The tyre sector produces all types of automotive and nonautomotive tyres whereas the non-tyre sector produces high technology and sophisticated products like conveyor belts, rubber seals etc. The wide range of rubber products manufactured by the rubber industry comprises all types of heavy duty earth moving tyres, auto tyres, tubes, automobile parts, footwear, beltings etc.

The rubber industry has been growing tremendously over the years. The future of the rubber industry is tied to the global economy. Rapidly growing automotive sector in developing economies and increased demand for high-performance tyres are expected to contribute to the growth of the global industrial rubber market. The current scenario reveals that there is a tremendous scope for the development of rubber processing industries. The global market for industrial rubber products is projected to increase 5.8 % per year. Investment in rubber industry is expected to offer significant opportunities in the near future and realizing returns to investors willing to explore this sector.

This book deals with all aspects of rubber processing; mixing, milling, extrusion and molding, reclaiming and manufacturing process of rubber products. The major contents of the book are rubbers materials and processing, mixing technology of rubber, techniques of vulcanization, rubber vulcanization, rubber compounding, rubber reclaiming, manufacture of rubber products, latex and foam rubber, silicone rubber, polybutadiene and polyisoprene, styrene butadiene rubber, rubber natural etc. The book contains addresses of plant & machinery suppliers with their Photographs.

It will be a standard reference book for professionals, entrepreneurs, those studying and researching in this important area and others interested in the field of rubber processing technology.

# Contents

## 1 RUBBERS: MATERIALS AND PROCESSING TECHNOLOGY

- Natural Rubber Plantation
- Tapping of Rubber Latex
- Preservation and Coagulation of Latex
- Chemical Nature of Natural Rubber Hydrocarbon
- Hydrogenated Rubber
- Cyclized Rubber
- Chlorinated Rubber
- Rubbers from Stereo-regular Polymerization of Isoprene and Butadiene
- Styrene-Butadiene Rubber (SBR)
- Polychloroprene Rubber (CR)
- Nitrile Rubber (NBR)
- Butyl Rubber (IIR)
- Ethylene-Propylene-Diene Terpolymer (EPDM)
- Polysulphide Rubber (PSR)
- Polyacrylic Rubber or Acrylate Rubber (ACR)
- Fluorocarbon Rubber (FKM)
- Introduction
- Mastication and Mixing
- Open Mill
- Internal Mixers
- Reclaimed Rubber
- Fillers
- Antidegradants
- Accelerators
- Retarders
- Activators
- Tyres
- Belting and Hoses
- Cellular Rubber Products
- Miscellaneous Applications of Rubber
- Passenger Tyre
- Tube Compound for Car tyres
- Conveyor Belts
- Insulation Compound for Cables
- Shoe Soles

## 2 MIXING TECHNOLOGY OF RUBBER

- Two-roll Mills
- Internal Batch Mixers
- Continuous Mixers
- Advantages of continuous mixing
- Disadvantages of continuous mixing
- Development of the Banbury Mixer
- Operating Variables
- Ram Pressure
- Rotor Speed
- Batch Size
- Coolant Temperature
- Unit Operations in Mixing
- Single-Pass Versus Multiple-Pass Mixing

Types of Mix Cycle  
Late Oil Addition  
Upside-down Mixing  
Sandwich Mixes  
Analysis of Changes to the Mix Procedure  
Acceleration of First-pass Compound  
Mill Mixing of Speciality Compounds  
Acceleration in Line with Internal Mixing  
Testing of Raw Materials  
Elastomers as Raw Materials  
Fillers  
Plasticisers and Process Oils  
Small Ingredients  
Control of Composition  
Tracking the Mix Cycle  
Compound Testing  
Basic SPC Charting  
Rheometer Data and its Meaning  
Mixing Control Software  
Peptisers in Natural Rubber  
Effects of Temperature  
Effects of Time  
Effects of Use Level  
Effects of Other Additives  
Peptisers in SBR  
Peptisers in Sulphur-containing Polymers  
Additives to Increase Viscosity  
Preventing Unwanted Chemical Reactions  
Filler Treatments  
Bin Storage Problems  
Inspection of Banbury Mixers  
Inspection at the Mezzanine Level  
Side Cooling  
Rotor Cooling  
Rotors and Bearings  
Rotor Bearing Lubrication  
Dust Stops  
Drop Door and Latch  
Hydraulic System  
Grease System  
Dust Stop Lubrication  
Drive Gears  
Couplings  
Inspection of the Banbury Platform  
Ram and Cylinder  
Heating Weight  
Piston Rod  
Weight Pin Assembly  
Hopper Door  
Air Line Filter  
Hopper Operation  
Mixer Maintenance and Lubrication  
Each time the mixer is started

Once per shift  
Once per day  
Once per week  
Once per month  
Every six months  
Anticipating Required Service  
Dust Stop Maintenance  
SSA Dust Stops  
Assembly  
Lapping  
Running  
Banbury Mixer " Hydraulic Dust Stops  
Assembly  
Run-in  
Lapping  
Production  
Flushing  
EPDM Expansion Joint Cover  
Expansion Joint Intermediate Layer  
Traffic Counter Treadle Cover  
SBR/IR Belt Cover  
EPDM Low Voltage Electrical Connector  
Peroxide-cured Black-filled EPDM Compounds  
EPDM Concrete Pipe Gasket  
Injection-moulded NBR Gasket  
CR/SBR Blend  
Low Durometer CR/SBR Blend  
Non-black CR for Injection Moulding  
Hard Rubber Industrial Wheel  
High Durometer NBR Masterbatch  
NBR/PVC Cable Jacket  
NBR/PVC/SBR Blend  
Butyl Masterbatch  
Butyl Masterbatch, Heat Interacted  
Chlorobutyl/NR Blend  
CSM CORD Jacket  
Non-black Millable Urethane  
Some Major Changes  
Tempered Water  
Power-controlled Mixing  
Energy Conservation  
Composition of EPDM Elastomers  
Variables in EPM and EPDM Elastomers  
Average Molecular Weight  
Molecular Weight Distribution  
Ethylene/Propylene Ratio  
Type of Diene  
Diene Level  
How Processing Relates to Structure and Rheology  
Practical Guidelines for Mixing EP Elastomers  
Using Internal Mixers  
Polymer Composition and Form  
Filler/Oil Levels and Types

Cure Systems  
Processing Aids  
Mixing Process  
Mixing Instructions  
Fill Factor  
Mixing Temperature  
Machine Parameters  
Ram Pressure  
Coolant Temperature  
Automation  
Machine Condition  
Downstream Processing Equipment  
Using Two-roll Mills  
Summary  
Rework  
Phase Mixing  
Natural Rubber Viscosity Reduction  
Measurement of Mixing Efficiency  
Special Considerations  
Raw Materials  
Typical Formulations  
Internal Mixing  
Mill Mixing  
Summary  
Accounting Methods  
Farrel Continuous Mixer  
Operating Principles of the FCM  
Commercial Applications for the FCM  
Farrel Mixing Venting Extruder (MVX)  
Designing the Rotor  
Analysis of Dispersive Mixing  
3 TECHNIQUES OF VULCANIZATION  
Pressureless Vulcanization  
Rubber Moulding  
Factors of Moulding  
Mouldin  
Compression Moulding  
Transfer Moulding  
Injection Moulding  
Helicure  
Buffed Tread Crumb  
Incineration and Pyrolysis of Tyres  
Reclaimed Rubber  
4 RUBBER VULCANIZATION  
Physical Property Tests  
Free Sulphur Determination  
Solvent-swell Method  
Mooney-Rivlin Equilibrium Modulus  
Differential Scanning Calorimetry  
Determination of Spring Constant  
Sulphur Vulcanization  
Peroxide Crosslinking  
Resin Vulcanization

Electron Beam Vulcanization  
Nitroso Compounds  
Metal Oxides  
5 RUBBER COMPOUNDING  
General Compounding Principles  
Tensile Strength  
Tear Resistance  
The Crescent Tear Test  
The Hardness of Rubber  
Set  
Abrasion Resistance  
Flex Cracking Resistance  
Resilience  
Heat Build-up  
Temperature Resistance  
Tyres  
Retreading Materials  
Conveyor Belting, Transmission Belting and Hose  
Footwear  
Rubber Roller  
Medical Applications  
â€œOâ€™ rings and Seals  
Rubber Blends  
Master Batches  
Choice of Rubber  
Fillers  
Vulcanizing Agents  
Peptizers  
Accelerators  
Activators  
Anti-oxidants  
Retarders  
Softeners and Plasticizers  
Rubber Crumb  
Factice  
Processing Aids  
Special Purpose Additives  
Unvulcanized compound properties  
Vulcanized compound properties  
6 RUBBER RECLAIMING  
7 MANUFACTURE OF RUBBER PRODUCTS  
Classification  
Components  
Tyre Building  
Parts of a Conveyor Belt  
Cover rubber  
Manufacturing Process  
Finished belt testing  
PVC Belting  
Steel Cord Belting  
Design of Hoses  
Hose Manufacture  
Braided/spiralled hoses

Testing of Hose  
Constructions  
V-Belt Manufacture  
Main Types of Power Transmission Belts  
Preparation of Ingredients  
Stability of Latex Compounds  
Manufacture of Latex Products  
Foaming and Gelling  
Vulcanization  
Classification and Terminology  
Fabric Lined Water-proof Shoes  
Canvas Shoes  
Micro-cellular Soling  
Manufacturing procedure  
Types of Mountings  
8 LATEX AND FOAM RUBBER  
Selection of Raw Materials  
Preparation of Raw Materials  
Compounding and Design  
Maturation  
Processing and shaping  
Dipped Goods  
Latex Thread  
Vulcanisation  
Hot Air Cure  
Hot Water Vulcanisation  
Autoclave Vulcanisation  
Radiation Vulcanisation  
Ultrasonic Wave Curing  
Testing of Rubber Products  
Packing and Marketing  
Conclusions and Recommendations

Manufacture of Latex Foam  
Dunlop Process  
Mechanism of Gelling  
Compounding  
Foaming and Gelling  
Construction of Moulds  
Curing  
Washing  
Drying  
Finishing  
Common Defects in Foam Making  
Shrinkage  
Foam Collapse  
Setting  
Complete Distortion of the Foam  
Protein estimation protocol  
Conclusion  
9 SILICONE RUBBER  
Electronics and Electrical Industries  
Silicone Rubbers to Mimic Flesh

Silicone Polymers  
Silicone Rubber Elastomers  
Reinforcing Fillers  
Semireinforcing or Extending Fillers  
Additives  
Curing Agents  
Mixing  
Freshening  
Moulding  
Extrusion  
Calendering  
Dispersion Coating of Fabric  
Heavy-duty Hose  
Bonding  
Bonding Unvulcanised Silicone Rubber  
Bonding Vulcanised Silicone Rubber  
Post-baking  
Condensation Cure – One-component  
Condensation Cure – Two-component  
Addition Cure  
10 POLYBUTADIENE AND POLYISOPRENE  
Polyisoprene  
Cyclopolyisoprene  
Gel and Branching  
Polybutadiene  
Isoprene  
Butadiene  
11 STYRENE BUTADIENE RUBBER (SBR)  
Raw Materials  
Production of Hydrocarbon Rubber  
Manufacture of Emulsion SBR  
Vinyl Content and Blockiness  
Molecular Weight and Branching  
Manufacture of Solution SBR  
Property Control  
Branching  
Blending  
Properties  
T<sub>g</sub> Measurement  
Molecular-weight Measurement  
Dynamic Mechanical Measurements  
Applications of SBR  
12 RECLAIMED RUBBER  
Whole Tyre Reclaim  
  
Drab and Coloured Reclaims  
Butyl Reclaim  
Scrap-rubber Preparation  
Reclaimed Rubber  
Digester Process  
Reclaimator Process  
Pan Process  
Engelke Process



Testing and Evaluations of Reclaimed Rubber  
Millroom Operations  
Special Strengths Through Reclaiming  
Further Advantages of Reclaiming - Applications  
Major Uses of Reclaimed Rubber  
Automobile floor mat  
Semi-pneumatic tyre  
Butyl inner tube  
Innerliner  
Carcass  
Applications  
Process  
Characterisation of Reclaimed Waste Latex Rubber (WLR)  
13 NITRILE AND POLYACRYLIC RUBBER  
Uses of Nitrile Rubber  
Mixing and Processing  
Latest Developments  
Composition  
Raw Polymer Characteristics  
Physical Characteristics  
Heat, Fluid, Low-temperature Resistance  
Applications  
Cure Systems  
Reinforcing Agents  
Plasticisers  
Process Aids  
Antioxidants  
Mixing  
Extrusion/Calendering  
Compound Storage Stability  
Vulcanisation  
Bonding Characteristics  
Solution Characteristics  
Blends  
Future Developments  
14 RUBBER NATURAL  
Agriculture  
Exploitation  
Latex Composition  
Types and Grades  
Production  
Latex Concentrate  
Processing  
Chemistry  
Physical Properties  
Economic Aspects  
Applications  
15. Addresses of Plant & Machinery Suppliers  
16. Plant & Machinery Photographs

## **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.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various 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.

---

**NIIR PROJECT CONSULTANCY SERVICES** , 106-E, Kamla Nagar, New Delhi-110007, India. **Email:** [npcs.india@gmail.com](mailto:npcs.india@gmail.com) **Website:** [NIIR.org](http://NIIR.org)

Sat, 27 May 2017 08:09:09 +0530