Rhodia

Chemistry is our world, Responsibility is our way

Key transformation processes

November 2009

Polyamide

The only fully integrated Polyamide 6.6 player with a strong position in Engineering Plastics

N° 2
in Intermediates and Engineering Plastics PA 6.6

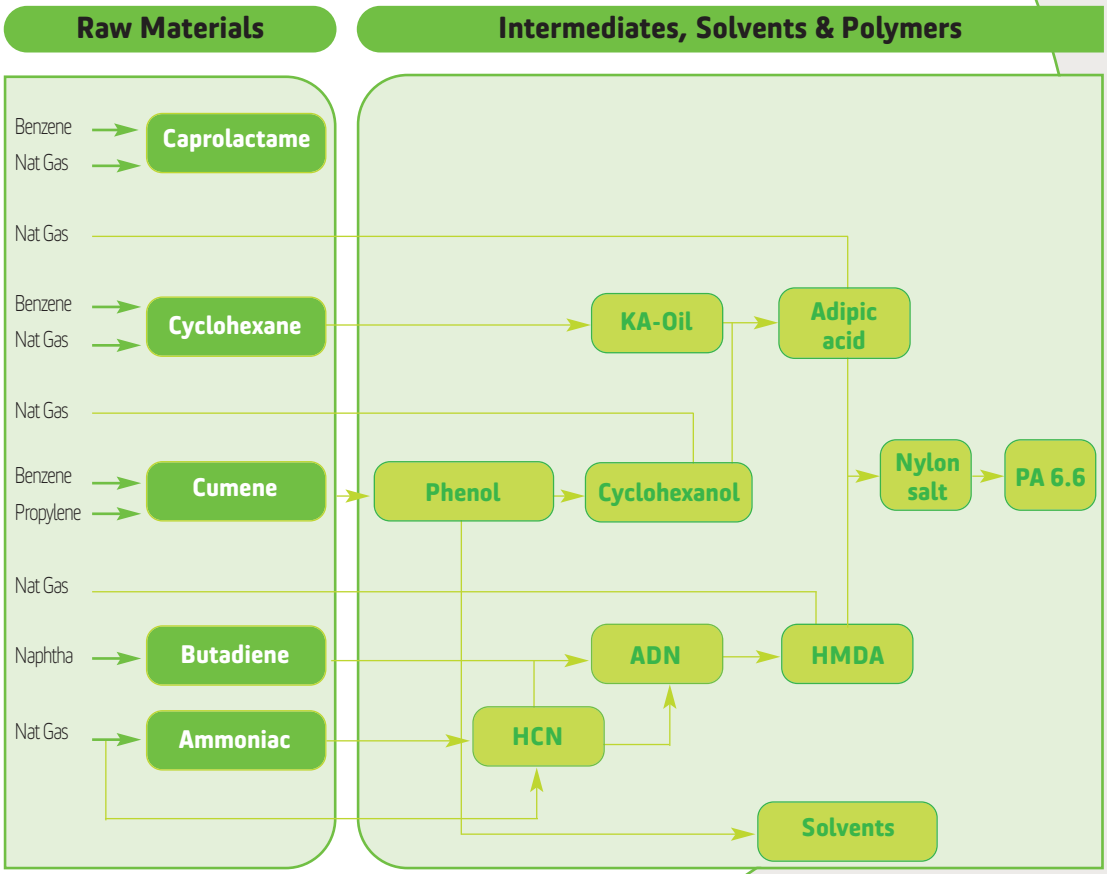
- **Major competitive advantage in upstream intermediates** (such as phenol, adipic acid, ADN, etc) and polymers thanks to Rhodia's expertise expertise and integration on the whole polyamide chain

- **High-performance product lines** with strong added value:
  - Polyamide 6.6 engineering plastics are used for their mechanical and thermal properties in high tech sectors
  - Performance fibers: exceptional properties in terms of flexibility, durability, heat resistance and recyclability
  - Textile and industrial yarns: performance and solutions meeting very specific requirements in clothing and industry
  - Solvents: based on polyamide technology, responding to environmental demands

- **Production sites:**
  - France
  - Spain
  - Germany
  - Poland
  - Canada
  - Brazil
  - China
  - Korea

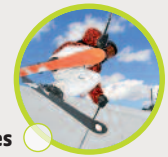
Polyamide

A fully integrated Polyamide 6.6 value chain

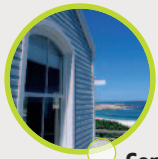


Main Markets

Automotive
> Inner engine
> Main body



Clothing & Shoes
> Outfit
> Sport equipment



Consumer & Industrial goods
> Coating and adhesives
> Electrical appliances

Silcea

Silica Business Unit

World Leader
in High Performance Silica

- **Rhodia is the inventor of High Performance Silica** for energy-efficient tyres, allowing five percent reduction in fuel consumption and CO_2 emissions
  - Rhodia' silicas are precipitated amorphous silicas, a non-hazardous product obtained from a process essentially using sand

- **High Performance Silica** is mainly used for its high dispersibility, outstanding absorption power and abrasion properties in the polymer industry, the feed and food industries or the oral care market

- **Unique player on the High Performance Silica** with operations on four continents

- **Production sites:**
  - France
  - Italy
  - Brazil
  - Venezuela
  - USA
  - South Korea
  - China

Silcea

Precipitated Silica – simple chemistry, complex production process based on a solid know-how

Raw Materials

- Sand
- \+
- Sodium Carbonate
- \+
- Sulfuric Acid

Main manufacturing steps

1. Furnace (1400°C) → Silicate
2. Precipitation of Silicate by Acid
3. Filtration – Washing

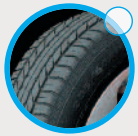
For Micropearl silica

4. Spray Drying in micropearl form

For Other silicas

4. Spray Drying
5. Grinding – Micronisation – Compacting

Main Markets



Automotive
> Energy tires

Personal Care
> Oral care

Animal nutrition

Silcea

Diphenols Business Unit

World Leader
in Diphenols and Vanillin

- **"Diphenol" derivatives includes Ethyl Vanillin and Vanillin**, Hydroquinone, Catechol

- **Unique eco-friendly and competitive processes benefit from over a century of expertise and** widely acknowledged as the best available technology in terms of water and energy consumption

- **Vanillin is the most widely used flavour and fragrance ingredient** in the world, in confectionary, baked goods, puddings, frozen deserts, beverages and many other foods. It is also used in perfumes, cosmetics, personal care products and detergents

  Hydroquinone is used as polymerization inhibitor in the monomer market. Catechol is mainly used as an intermediate in the flavour & fragrances and agrochemicals industries

- **Unique market player** to be present in Europe, the USA and China

- **Production sites:**
  - France
  - USA
  - China

Silcea

Diphenols – the technological reference in all 3 production steps

Raw Materials

- Phenol
- Oxigen Peroxide
- Catalysts
- Methyl Chloride
- Glyoxilic Acid

Main manufacturing steps

For Hydroquinone / Pyrocatechol

1. Oxidation
2. Distillation
3. Cristalisation
4. Flaking

For Diphenol Ether

1. Alkylation
2. Distillation

For Vanillin / Ethylvanillin

1. Carbon-Carbon Condensation
2. Oxidation
3. Cristalisation

Main Markets

Flavours & fragrances
> Food
> Perfumes

Agrochemicals
> Crop protection
> Fertilizer

Industry & processing
> Monomer inhibitors
> Synthesis intermediates

Silcea

Electronics & Catalysis Business Unit

World leader
in Rare Earths-based formulations

- **Rare earths are natural elements** present in large quantities in the earth's crust. After separation to extremely high purity levels, Rhodia formulates the resulting concentrate into high-technology and "green oriented" materials

- Automotive emission control. **As the leader in emissions control materials for gasoline and diesel vehicles**, particulate filters using Rhodia's additive technology equip today four million vehicles. The Rhodia's gasoline emission control range is present in one out of two catalytic converters worldwide
  - Electronic applications. Rhodia's phosphor precursors minimize raw material usage, waste volumes and enable significant energy savings. They are widely used in electronic industry

- **Unique market player in the Rare-earths** materials serving customers in and outside China

- **Production sites:**
  - France
  - USA
  - China
  - Japan

Silcea

Rare Earths* – tailored made technologies

Raw Materials

Ore

Main manufacturing steps

1. **Dissolution - Separation**
2. **Solid-Liquid precipitated of solid compounds**
3. **Cristaline phase and morphology control by thermal treatment**
4. **Finishing**

* *Main Rare Earths: Cerium, Lanthanum, Gadolinium, Terbium, Yttrium, Praseodymium, Neodymium, Europium, Dysprosium*

Main Markets

Automotive

> Gasoline & diesel emission control

Electricals & electronics

> Low consumption light bulbs
> Lighting for LCD screens, computers
> Polishing powder

Consumer goods

Novecare

Surfactants

World Leading

position in mild amphoteric surfactants

- **Supplying a wide range of surfactants** — cationic, anionic, non-ionic and amphoteric — delivering multi-functions adapted to specific applications (foaming effect, surface modification, cleansing, emulsion, rheology, environmental and health protection)

- **Rhodia develops innovative surfactant systems** – novel structured surfactant liquids, polymeric and eco-friendly surfactants – that support our customers' challenges: cost-effective performance and sustainable process and products

- **Surfactants are used as performance additives** in formulations in a large number of industries, such as personal and home care and numerous industrial applications (metal treatment, industrial cleaning, petroleum extraction, coatings, agrochemicals)

- **Production sites:**
  - France
  - United Kingdom
  - Italy
  - USA
  - Brazil
  - India
  - Thailand
  - China
  - New Zealand
  - Indonesia

Novecare

Surfactants value chain

Raw Materials

Natural Feed stock

ie coconut oil

Petroleum Feed stock

ie Ethylene oxide, Ammonia

Main manufacturing steps

Chemical proccess

Sulfonation
Alkoxylation
Phosphation
Condensation

→

Chemical products

Surfactants:
- Amphoterics
- Anionics
- Non-ionics
- Cationics

Formulated surfactants & Blends

Main Markets

Home & Personal Care
> Skin Care
> Hair Care
> Home care

Agrochemical specialties
> Herbicide formulations
> Environmentally friendly solvents

Industry & Processing
> Metal treatment
> Industrial cleaning

Novecare

Phosphorous derivatives

World Leader
in Phosphorous Chemistry

- **Built on Rhodia core competencies**, the phosphorus derivatives business offers a broad range of existing specialty phosphorus products

- **A variety of technologies** to meet the expectations in the areas of industrial efficiency, performance, innovation and respect for the environment

- **Leading positions in the phosphorus specialty market** such as:
  - Phosphonates for water treatment
  - Biocides for oil and gas
  - Flame retardant for fabric treatment
  - Ligands for Pharmaceutical intermediates

- **Production sites:**
  - United Kingdom
  - USA
  - China

Novecare

Phosphorous derivatives

Raw Materials

Elemental P4

Transformation processes

1 **Primary derivatives** → Chemical Intermediates

2 **Secondary derivatives**

- Halide derivatives → Ethephon, Phosphonates, specialty der.
- Phosphine derivatives → THPX, specialty der.
- Fine chemicals → Specialty derivatives

Main Markets

Industry & Processing

> Oil and gas field
> Water treatment
> Fine chemicals & pharma
> Metal surface treatment

Consumer goods and textiles

Acetow

Filter tow process

Benchmark
in quality
and innovation

> **Based on cellulose acetate**,
- Filter Tow is made from renewable resources (wood pulp) and is biodegradable
- Cellulose acetate flakes result from the chemical reaction of acetic anhydride with wood pulp
- Acetate tow is derived from the physical transformation of cellulose acetate flakes

> **Cellulose acetate tow** is mainly used for making cigarette filters. High product quality and exemplary customer service has secured Rhodia a leading position

> **Production sites:**
- Germany
- France
- USA
- Brazil
- Venezuela
- Russia

Acetow

«Tow» production process

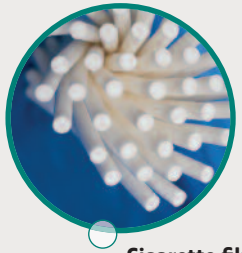
Main Market

Raw Materials

- Wood Pulp
- +
- Acetic acid
- +
- Anhydrid

Main manufacturing steps

- Acetylation
- Precipitation – Drying
- Acetate Flakes
- Dissolution of cellulose acetate in acetone
- Spinnning
- Crimping
- Drying
- Packaging



Cigarette filters

Eco Services

Sulfuric acid life-cycle management

US leader
in Sulfuric Acid
life-cycle management

- Rhodia is a leading supplier of **sulfuric acid life-cycle management** in North America

- Sulfuric acid life-cycle management is **an energy efficient, sustainable solution for the re-use of sulfuric acid** in industrial applications. Many of Eco Services' customers use sulfuric acid as a catalyst for refining and for producing alkylate, an essential component of high-octane gasoline

- **Rhodia mainly serves refineries and other chemical manufacturers**, which depend on Eco Services for sulfuric acid supply and rigorous management of the sulfuric acid product life cycle. Through unmatched technical expertise, a network of six production sites and related logistics, Rhodia's offers unparalleled reliability

- **Production Sites in the USA:**
  - Hammond, IN
  - Baton Rouge, LA
  - Baytown and Houston, TX
  - Dominguez and Martinez, CA.

Eco Services

Sulfuric Acid life-cycle management Process

Raw Materials

Spent Sufuric Acid

Main manufacturing steps

1. **Storage and mixing**
2. **Furnace**
   - Fuel
   - Air
   - Sulfur derivatives
3. **Boiler**
   - Steam for Plant
4. **Quench**
5. **Coolers**
6. **Electrostatic Precipitator**
   - Purification
7. **Drying Tower**
   - Sulfuric Acid
8. **Absorption Tower**
9. **Catalytic Converter**
   - Oxygen
   - SO_3
10. **Commercial Sulfuric Acid**

Main Markets

Energy & Greenhouse gases

> Acid sulfuric acid regeneration for oil refineries
> Treatment services
> Industrial

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