

# Disruptive Technology Trends

*Specialty Chemical Sector*

**2021**

# Top Technology Disruptive Trends in Specialty Chemicals

IEBS has identified the top disruptive technology trends in the special chemical sector for 2021

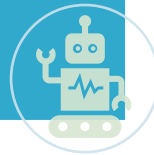
- Aroma compounds, also known as an odorant, aroma, fragrance or flavor, is a chemical compound that has a smell or odor.
- Flavor and fragrance compositions as well as the essential oils, natural extracts, and aroma chemicals that serve as starting materials.

**Cosmetics and Personal Care**



- Sustainable movements such as water efficient product, biodegradable surfactants, co2 utilization technologies affecting overall home care ingredients sections.
- Post Covid 19 disinfectant chemical has showing sharp growth in market shares which will continue in upcoming years as well

**Home Care Ingredients**



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- Flavor and fragrance compositions as well as the essential oils, natural extracts, and aroma chemicals that serve as starting materials.

**Flavor & Fragrance**



- Any toxic substance used to kill animals, fungi, or plants that cause economic damage to crop or ornamental plants or are hazardous to the health of domestic animals or humans.
- The term pesticide includes all of the following: herbicide, insecticides, molluscicide, rodenticide, bactericide, antimicrobial, and fungicide

**Pesticides**



- Different catalysts are in constant development to fulfil economic, and environmental demands.
- Catalyst might be used to replace a polluting chemical reaction with a more environmentally friendly alternative.

**Catalyst**



- Electronic chemicals are the chemicals used in electronic industry to manufacture semiconductor components, ICs and PCBs. With increasing use of semiconductors in industries such as aerospace, defense and automotive as well as for the manufacturing of smartphones, computers, electronic appliances, tablets, etc.,

**Electronic Chemicals**



- Additives are important components commonly used at low concentrations in excipients. Additives provide certain functions such as enhancing stability, modifying pH, preventing microbial growth, etc.

**Pharmaceutical Additives**



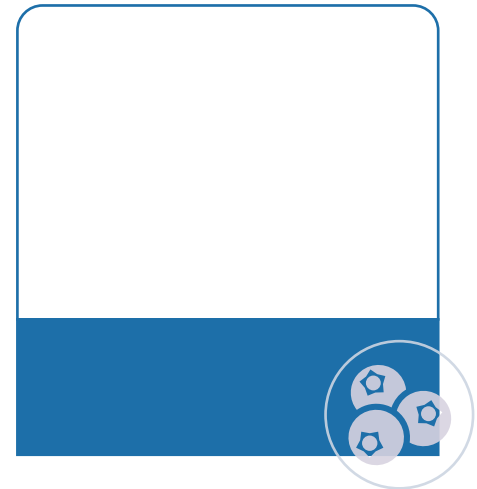
- Feed additives are minor components of the animal ration and are used for improving the quality/digestibility of feed and the nutritive and aesthetic quality of food or improving animal performance and health.

**Food & Feed Additives**



- Construction chemicals are used by the construction and civil repair industry. These chemicals help enhance concrete strength and quality, provide water-tightness and protect concrete structures from atmospheric degradation.

**Construction Chemicals**



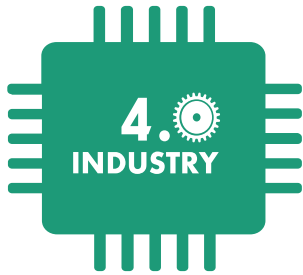
# Cosmetics and Personal Care

Key Players Activity	Key Technology Trends
<ul style="list-style-type: none"><li>• BASF invests to produce Uvinul® (<b>UVA protection ingredient</b>) A Plus in Asia</li><li>• L'Oréal's Garnier is the first major mass market brand to launch a range of zero waste shampoo bars onto the UK market.</li><li>• Unilever research identifies mouthwash technology containing Cetylpyridinium chloride (CPC) has potential to reduce viral load of SARS-CoV-2 virus by 99.9%</li><li>• Kaffe Bueno. A Denmark based biotech startup closes €1.1m seed round, plans 2021 active ingredient launches.</li></ul>	<div data-bbox="784 251 1065 279"><b>Green Ingredients</b></div> <div data-bbox="784 294 2040 451"><p>Scientists are creating new ingredients derived from nature or utilizing the waste material to create value added product. For example extraction from plants or deriving sustainable ingredients by upcycling food waste have been gaining more interest.</p><p><i>British brand UpCircle Beauty has launched oils, scrubs and soap bars based on used coffee waste and chai spice granules.</i></p></div> <div data-bbox="2074 277 2257 462"></div> <div data-bbox="784 472 909 501"><b>Hygiene</b></div> <div data-bbox="784 515 1921 665"><p>Keeping skin, hair, body as well as beauty tools germ free has become major focus due to global pandemic. Beauty industries are expecting to see high demand in antibacterial personal care product sector.</p><p><i>Cosmetic Sanitizer Mist by BeautySoClean is one of such product specifically formulated to sanitize makeup.</i></p></div> <div data-bbox="1982 522 2104 686"></div> <div data-bbox="784 682 1057 711"><b>Human Microbiota</b></div> <div data-bbox="784 725 1921 882"><p>Cosmetics scientists have been able to measure the importance of the skin microbiome in hygiene and personal care. Probiotics and prebiotics from gut microbiota promote skin benefits</p><p><i>Synbio® skin care products contain a high concentration of probiotics and prebiotics</i></p></div> <div data-bbox="1946 729 2137 876"></div> <div data-bbox="784 889 1192 918"><b>Controlled Delivery System</b></div> <div data-bbox="784 932 1972 1053"><p>Developers are focusing on technologies which can modulate the release of active materials based on desired kinetics.</p><p><i>Prolabin &amp; Tefarm has developed biocompatible lamellar synthetic clays based on innovative intercalation technologies show good results in terms of controlled release.</i></p></div> <div data-bbox="1989 925 2137 1072"></div> <div data-bbox="784 1071 1044 1099"><b>Nutri-ingredients</b></div> <div data-bbox="784 1113 2091 1332"><p>Importance of various antioxidant and vitamins on skin health is well established. Consumers now are inclined to take more holistic approach to develop good skin health. Effective dietary ingredients, glucosaminoglycan extracellular matrix plays an important role to prevent skin aging.</p><p><i>Delphinol: An innovative and unique extract with exceptional anti-aging, anti-inflammatory and anti-oxidant benefits. Developed using Maqui Berry, the most powerful antioxidant super fruit in the world.</i></p></div> <div data-bbox="2109 1125 2260 1282"></div>



## Spotlight on Cosmetics Regulations

- The U.S. Federal Trade Commission (FTC) announced its first law enforcement crackdown on deceptive claims in the growing market for cannabidiol (CBD) products.
- China releases regulations on supervision and administration of cosmetics for the cosmetics industry that shall be applicable from 2021
- More than 400 beauty companies and brands have signed an open letter to stand against new animal testing regulatory decisions made by the ECHA where some widely used cosmetics ingredients need to be tested on animals



# Home Care Ingredients

## Key Players Activity

- Unilever and Innova Partnerships have launched a joint venture biotechnology company, Penrhos Bio, to commercialise a technology that means self-cleaning surfaces could become a reality.
- Clariant launches next-gen cosmenyl™ 100 pigment dispersions with a new state-of-the-art preservation system that suitable for coloring home and fabric care applications



## Spotlight on Regulations

- A.I.S.E. putting focus on product resource efficiency projects to reduce packaging size
- To support companies A.I.S.E. has developed guideline principles on sustainable sourcing of bio-based materials

## Key Technology Trends

### Sustainable Cleaning Solutions

#### Biodegradable surfactant

Break down and decompose into by-products found in nature in a short period of time.  
[Evonik Industries](#) to develop rhamnolipids, a renewable and biodegradable surfactant

#### CO2 Utilization

Replace non-renewable sources (black carbon) with captured CO2.  
[CleanO2](#) has developed the technology to turn CO2 emissions from industrial process into potash for use in soaps, detergents

#### Water-efficient formulations

Novel technologies that reduce the needs of water requirement  
[Xorbs](#) are high performance spherical polymers that reduce water consumption for laundry purpose.

#### Low carbon chemistry

Plants and biological (green), marine algae (blue) and carbon recovered from waste material like plastic (grey).  
[Centre for Enzyme Innovation at the University of Portsmouth](#) innovate novel enzyme produced from agricultural waste that could be used as additive in detergents

#### Microbiome Technology

Harness the natural cleaning power of 'good' probiotic bacteria which effectively inhibit the harmful bacteria that cause infections.  
[Aunt Fannie's probiotic range](#) includes hand soap, dish soap, cleaning wipes and multi-surface cleaners, and boasts only plant-based ingredients.

#### Multi-layer protective shield

[Microban 24](#), a antibacterial home sanitizing products lunched by P&G kill 99.9% of bacteria on contact

#### Natural disinfecting product

Thymox® Technology is environmentally friendly, non-toxic, non-corrosive, and biodegradable.

#### Multi-purpose surfactant blend

A cost effective simple surfactant blend that provides high performance  
[Aspire® HS Super Concentrate](#) comprised of cationic, anionic, and non-ionic surfactants that work synergistically

#### Smart Polymer

It prevents surface from building up soap scum and lime scale.  
[Aristocare™ Smart](#) developed by Clariant protect surfaces and helps to reduce the time needed for cleaning

#### Hybrid Polymer

Provide formulation efficiency and higher performance  
[Alcoguard® H 5941](#) developed by nouryon is a readily biodegradable hybrid polymer based on natural and synthetic components

### Other Developments

## Flavor & Fragrance

- **Flavors and fragrances** are integral components of a wide range of consumer goods. Flavors affect both the sense of taste and smell, whereas fragrances affect only smell.
- For an individual chemical or class of chemical compounds to impart a smell or fragrance, it must be sufficiently volatile for transmission via the air to the olfactory system in the upper part of the nose.



## Key Players

## Key Players Activities

- 1) BASF Enters Natural Flavour & Fragrance Markets: In a move to expand its presence in the natural flavor and fragrance business, BASF has acquired Isobionics and formed a cooperative agreement with Conagen.
- 2) Advanced Biotech, are helping to foster research about sustainable methods and practices in the flavors and fragrances industry
- 3) [Bell Flavors & Fragrances](#) EMEA have launched inspirational fragrances trends of 2020/21 based on our fascinated planet theme. Like Ocean Vibes, Australian Inspiration, Planet Lover.

## Regulations

- 1) Restricted Flavors:- Coumarin and dihydrocoumarin, Tonkabean (Diptera adorat),  $\beta$ -asarone and cinnamyl anthracite, Estragole, Ethyl Methyl Ketone, Ethyl-3-Phenylglycidate, Eugenyl methyl ether, Methyl  $\beta$  naphthyl Ketone, p-Propylanisole, Safrole and Isosafrole, Thujone and isothujone  $\alpha$  &  $\beta$  thujone

## 01



## Natural Ingredients

Colours and flavours from natural sources and ingredients are becoming key focus of new innovation. Some popular natural ingredients are botanical extracts from various plant sources such as **guaiaac wood, citrus oils, corn mint, Eucalyptus**, and other.

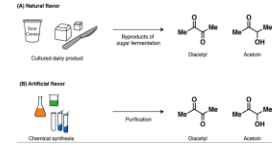
# 03



## Natural Processing Technique

Many big brands have started to follow natural processing like animal cruelty free, and 100% vegan ingredients being utilized. For example:- [Olam](#) Cocoa to develop TrueDark under its deZaan brand, a cocoa powder that has not undergone alkalisied processing, when the powder is washed with a potassium carbonate solution.

## 02



## Synthetic Ingredients

Synthetic fragrances are less expensive compared to natural variants. They are also possibly safer since they have been thoroughly tested and used. **Vanillin, Ethyl Acetate, Menthol,** and others

## 04



## Fusion Technology

It's an upcoming technology where consumers can mix and fuse their favourite fragrances which can create an exotic and different fragrance altogether. Artiris' 'smart diffuser,' called [Compoz](#), lets users insert up to five scented oil pods at a time. From there, they can select different scents and change their intensity in real time.

# Pesticides

- **Pesticide** is a chemical (such as carbamate) or biological agent (such as a virus, bacterium, or fungus) that deters, incapacitates, kills, or otherwise discourages pests.
- **Insecticides** have a pivotal role in our lives, not only for crop protection in agriculture, but also to avoid the spreading of harmful pests causing human diseases such as malaria.



## Key Players

## Key Players Activities

- 1) [BASF](#)'s latest insecticide Broflanilide received the first registration worldwide by the Australian Pesticides and Veterinary Medicines Authority (APVMA).
- 2) [Syngenta](#) Crop Protection announces launch of Spiropidion: a new insecticide active ingredient

## Restrictions

- 1) Ban on POPs pesticides. [POPs](#) chemicals don't break down easily and can remain in the environment for a long time. Many of them evaporate in hot climates, travel through the atmosphere and settle in colder environments. They are also lipophilic meaning that they are soluble in fat. This means that they tend to accumulate in the body fat of animals in ever increasing quantities eventually leading to long term physiological effects such as infertility.
- 2) The EU reduced its [maximum residue level](#) (MRL) for tricyclazole, a fungicide used for control of neck blast in rice, a hundred-fold to 0.01 parts per million (ppm) or 1 milligram per 100 kg from January 2018.

## 01

### Microbial pesticides

Microbial pesticides consist of a microorganism (e.g., a **bacterium, fungus, virus or protozoan**) as the active ingredient. Microbial pesticides can control many kinds of pests, although each separate active ingredient is relatively specific for its target pest. **Bacillus thuringiensis**, or **Bt**, kills one or a few related species of insect larvae.

## 03

### Fly Baits

Use of insecticide sticker panel is one of the latest innovations for discreetly controlling a wide variety of fly species. Fly Bait involves ingredients like **vinegar, sugar, and dish soap**. This technique has been proven to be suitable for managing houseflies, phorid flies, blowflies, fungus gnats, fruit flies, and bottle flies.

## 05

### Nano pesticides

There are very few publications that carefully analyze the benefits—and risks—of so-called “nanoagrochemicals” against their conventional alternatives. In most cases, the increase in efficacy is quite limited. However, in some cases researchers have observed improvements by an order of magnitude under laboratory conditions. [Canadian Vive Crop's Allosperse Delivery System](#) is possibly the best example.

## 02

### Biochemical

Pesticides include all naturally occurring substances (or their structurally similar synthetic analogs) that are intended for use as attractants, repellents, desiccants, semiochemicals, plant and insect regulators, and induced systemic response (ISR) and systemic acquired response (SAR) inducers. **juvenile hormone, Methoprene** are few of the examples of [biochemicals](#).

## 04

### Non-toxic Heat Treatments

Modern heat treatments that are scaled up for commercial use include the use of **infrared rays** that penetrate surfaces of pests. The big advantage of this treatment includes the avoidance of the development of insects' resilience to spray chemicals. [Thermo-bug](#) and [absolute pest management](#) have been trying this technology.



- **Catalyst** are substances that alters the speed of the reaction by providing an alternate path for the reaction to take place.
- Catalyst can be classified as **acidic, basic, homogeneous, heterogeneous**, and other. Some catalyst hinders the rate of reaction which are also known as **poisons**.

## Key Players

ALBEMARLE®

HALDOR TOPSOE

lyondellbasell  
Advancing Possible

BASF

We create chemistry

EVONIK  
POWER TO CREATE

## Key Player Activities

- 1) [BASF](#) introduces Fourtune FCC catalyst for maximizing butylene selectivity over propylene.
- 2) [BASF](#) launches a new Tri-Metal Catalyst, developed in collaboration with and sponsored by Sibanye-Stillwater and Impala Platinum.
- 3) [Evonik](#) acquires Porocel for US\$210 million to accelerate growth of catalysts business.

## Organocatalyst



[Organocatalyst](#) is an alternative catalyst against the expensive metals used for reactions. But its regeneration is a problem that is still a problem to be solved completely. Therefore, this material is still a trending technology.

## Nanoparticles



The photocatalytic degradation of methylene blue was chosen to evaluate the photocatalytic activity of [N-ZnO nanoparticles](#), with results indicating that the material exhibited higher activity towards the degradation of methylene blue.

## Sustainable catalysis

- Due to the diminishing resources of precious metals, [Jacob R. Ludwig](#) working on an approach for the development of more sustainable catalysis is the use of metals with high crustal abundance, which are often referred to as base metals.
- Moreover, [Lutz Ackermann](#) is a Professor at the Georg-August-University Göttingen has developed novel concepts for sustainable catalysis constitutes his major current research interest, and he has a topical focus on C-H activation.



## Dehydrogenation Catalyst

Hydrogen is emerging as an alternative e-fuel. Therefore, its required to collect hydrogen in an efficient manner from various reaction for which efficient catalyst are required. [Nobel metal catalyst](#) has been upcoming solution for dehydrogenation.



## Refinery Catalyst

Catalyst for various refinery purposes are in latest trend. Like converting more useful product during cracking of crude oil or converting [CO2](#) to [methane](#) etc.

- The electronics industry uses a broad range of highly sophisticated specialty chemicals in many processing steps in the manufacture of electronic components and products, including silicon wafers and integrated circuits, for packaging and printed circuit boards (PCBs), in the manufacture of compound semiconductors and optoelectronics, and in the production of flat panel display products.



## Key Players Activities

- 1) [Honeywell Technology](#) Is Helping To Keep Phones Cool with availability of a Thermal Interface Materials (TIM) solution.
- 2) [Linde](#) and Daimler Truck to Collaborate on Hydrogen Refueling Technology.
- 3) BASF and [Cellnex](#) will bring 5G technology to the Tarragona production centre.

## 01

### Polyfluoroalkyl Substances

PFAS are also essential to semiconductor manufacturing equipment and factory infrastructure. The exceptional combination of their heat and chemical resistance and their chemical inertness allows fluoropolymers to be used both in equipment components and lubrication.

## 03

### Chemicals in Telecom Communication

Chemical Engineering and Chemistry play a significant role in the majority of information and communication technologies that support an industry that collects, processes, displays, stores, retrieves, and transmits vast quantities of digital data. For e.g., **barium carbonate**, **silicon dioxide**, **yttrium oxide** are used as raw material for antennas.

## 05

### Electroplating

- Electroplating is a general name for processes that create a metal coating on a solid substrate through the reduction of cations of that metal by means of a direct electric current.
- Nanocrystalline metals provide greater hardness, wear-resistance, ductility, and corrosion resistance compared to traditional metal surfaces.
- The aim of electroplating technology is to develop non-metal substrates. Future composite materials will be non-metallic with reinforcements in the form of Kevlar, carbon or glass.

## 02

### New Day Batteries

- Sodium-ion battery which are being considered as an alternative for lithium in smartphones. Another example is [Aluminum-air battery](#) which are used in cars and manages to give 1,100 miles drive in a single run.

## 04

### Thin Films for Solar Panel

- A thin-film solar cell is a second-generation solar cell that is made by depositing one or more thin layers, or thin film (TF) of photovoltaic material on a substrate, such as glass, plastic or metal.
- [University of Cambridge](#) is working with a promising new family of materials known as halide perovskites. Perovskite inks are deposited onto glass or plastic to make extremely thin films – around one hundredth of the width of a human hair.

# Pharmaceutical Additives

- Any substance other than the active drug that is included in the manufacturing process or is contained in a finished pharmaceutical dosage form.
- Antioxidant, Humectant, Stiffing agent, Suspending agent, Flavoring Agent, Coloring Agent, Emulsifying Agent, Polishing Agent are few examples of excipients/additives in pharmaceutical drugs.



**Associated  
British Foods  
plc**

**Lubrizol**  
**CRODA**

**Key Players**



We create chemistry



## Key Players Activities

- Liposomes enhance effective drug delivery: [CORDENPHARMA](#)
- [Celanese](#): VitalDose® Ethylene Vinyl Acetate (EVA) excipients are used for controlled-release drugs, medical implants and combination devices.

# 01



## Sugar

- Sugar spheres (also called neutral pellets, nonpareil seeds, microgranules or sugar beads) are produced, preferably using a layered sugar-coating structure which result in sufficient mechanical stability for further processing.
- The common sugar alcohol, mannitol ( $\text{HOCH}_2(\text{CHOH})_4\text{CH}_2\text{OH}$ ), can be used as a pharmaceutical excipient, a non-dietary ingredient in dietary supplements. Mannitol, with its sweet taste and pleasant mouthfeel, may serve the same purpose in confectionaries, chewable dietary supplements, or oral medications.

# 03



## Edible Polymer

- With a rising demand for green materials to produce new, environmentally safe, edible polymers from natural polymeric materials have been attracting considerable attention in recent years. Edible polymers are mainly composed of polysaccharides, proteins and lipids. Biocompatibility and biodegradability are preferred properties of edible polymer used in biomedical field.
- Most capsule products manufactured today are of the hard gelatin type.

# 02



## Film Coating

Pharmaceutical industry now requires technology for coating not only core tablets and pellets, but also other delivery systems such as catheters, ingestible imaging instruments, stents, joint plates etc. For example, near infra-red techniques which can be used to analyze coated product in a manner that, the in-process quality tests such as; moisture contents, drug contents, amounts of the applied film coating can be predicted before the end of the coating process and before the product is being discharged from the coating pan

# 04



## Nanotechnology

- Nanotechnology offers multiple benefits in treating chronic human diseases by site-specific, and target-oriented delivery of precise medicines. Recently, there are several outstanding applications of the nanomedicine (chemotherapeutic agents, biological agents, immunotherapeutic agents etc.) in the treatment of various diseases.
- Zein, an alcohol-soluble protein in corn, can self-assemble into spherical nanoparticles, which makes it an ideal carrier material for the encapsulation of hydrophobic bioactive molecules.

# Food & Feed Additives

- Food additives are substances added to foods to perform specific functions. Additives may be natural, nature identical or artificial.
- The main groups of food additives are **antioxidants, colors, flavor enhancers, sweeteners, emulsifiers and stabilizers and preservatives.**



## Key Players Activities

- 1) [Cargill](#) invests \$15 million in new bio industrial plant in India.
- 2) [CP Kelco](#) launches new pectin to simplify fruited drinking yogurt production
- 3) "Alternative Proteins: Taste and Texture Reigns in Creating Plant-Based Products" – [Food Ingredients First](#)

## Regulations

- 1) US FDA amending additive norms to disallow seven flavouring substances.
- 2) FSSAI: Certified colours and colours exempt from certification
- 3) FSSAI re-operationalises regulations on formaldehyde in fish

## 01

### Preservative

Ozone quickly decomposes into oxygen molecule and possess a high oxidation potential making it a good antimicrobial and antiviral agent. Apart from this, ozone removes the necessity to store harmful chemicals as the gas can be made instantly. Also, in comparison with chlorine, its degradation leaves negligible residue when treated with solid foods or beverages.

## 03

### Health Benefits

Lutein is a type of vitamin called a carotenoid. Lutein is a nutrient best known for its help maintaining eye health, it also helps preserve and boost brain activity, improving memory, learning efficiency, and verbal fluency.

## 02

### Alternative Cell-Based Proteins

There is growing consumer awareness of, and interest in, alternative proteins. Meat has been the main source of protein in developed markets for years because of which plant-based food sales have been increased.

**Fermented proteins and cultured meat** are also being considered as an alternative as well.

## 04

### Probiotics in food additives

- Consumers across the world understand the benefits of probiotics for gut health. Therefore increasing demand for products with digestive health benefits
- GanedenBC30® (Bacillus coagulans GBI-30, 6086) is a natural, hardy probiotic ingredient used by product manufacturers to create a wide range of probiotic-fortified foods and beverages.

# Construction Chemicals

They are used to speed up the process or add more sustainability and strength to the structures. The addition of construction chemicals to various building materials during the construction work improves performance, workability, adds functionality, and protects the basic or customized elements of a structure. **Adhessive, sealant, decorative agents** are few areas for construction chemicals.



## Key Players Activities

- 1) [Nanex](#) combined nanotechnology and nature for waterproofing.
- 2) [Evonik](#) specialty chemicals facilitates construction under Belt and Road.
- 3) [Solidia Technologies](#) Named a Global Cleantech 100 Company for Fourth Year.

## 01

## Cladding Technology

- An in situ hot press bonding technology has been developed to clad **aluminium** on magnesium. Followed by regular hot rolling, magnesium sheets, covered by ductile and corrosion-resistant aluminium without detectable oxides in the interface, are produced. The new technology requires no welding, vacuum, protective atmosphere or barrier layer.
- Another trending technology is Laser cladding technology allows materials to be deposited accurately, selectively and with minimal heat input into the underlying substrate.

## 02

## Sustainable Technique

Optimized energy efficiency and a drive for low to zero carbon emissions have driven innovation in building construction and service design for years. In response, new, better thermal performance materials are being developed.

- **Electrochromic glass** can shift from clear to opaque based on external stimuli such as an electrical current or UV rays. It eliminates the need for shades and other window treatments, while adapting to current conditions passively.
- **Solar thermal cladding** is a passive solar building method designed specifically to hold heat during the winter.

## 03

## Waterproofing Technology

Many nanotech solutions have made their way into everyday life – one of the most prominent being the use of ceramic coating for waterproofing.

- Nano coating is hydrophobic (water repellent), oleo phobic (oil repellent) surface layer that repels water, oil, dirt, and other dry particles.
- Superhydrophobic coatings are used in dry surface application.

## 04

## Building Material

- Energy-efficient, highly reflective roof coatings made from **acrylics, urethanes, silicones, and styrene block copolymers (such as SBS and SEBS)** can lengthen the life of a roof, help lessen air leaks, reduce heat transfer and decrease thermal shock.
- Lightweight yet durable materials like **polyurethane** is used in building and construction applications, thanks to its strength-to-weight ratio, insulation properties, durability and versatility.



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