

RENEWED BASICS

PART 2

Innovation in interior materials extends the sustainable elements of a building's envelope and functioning into its daily operation. The truth is that building occupants spend more time in the office and so the reformulation of products to make them sustainable is crucial to employee wellbeing. In the second part of renewed basics, we explore how interior products are being made over for sustainable working spaces.

WORDS MICHELLE LUDWIG



Innovative products are helping to create green interiors, which will be receiving more attention with the release of a new rating tool by the Green Building Council of South Africa (GBCSA) - Green Star SA Interiors. This tool applies to various tenancy types such as office, retail, healthcare and hospitality.

"If one looks to how these interior rating tools have affected industries in the USA and Australia, the rating tool will have an enormous impact on the downstream materials and product manufacturing industry in South Africa," says Lesley Sibanda, project manager of the tool for the GBCSA. Now there will be even more incentive to use environmentally-responsible materials and technologies in interior applications, particularly those that address occupant health and thermal comfort issues.

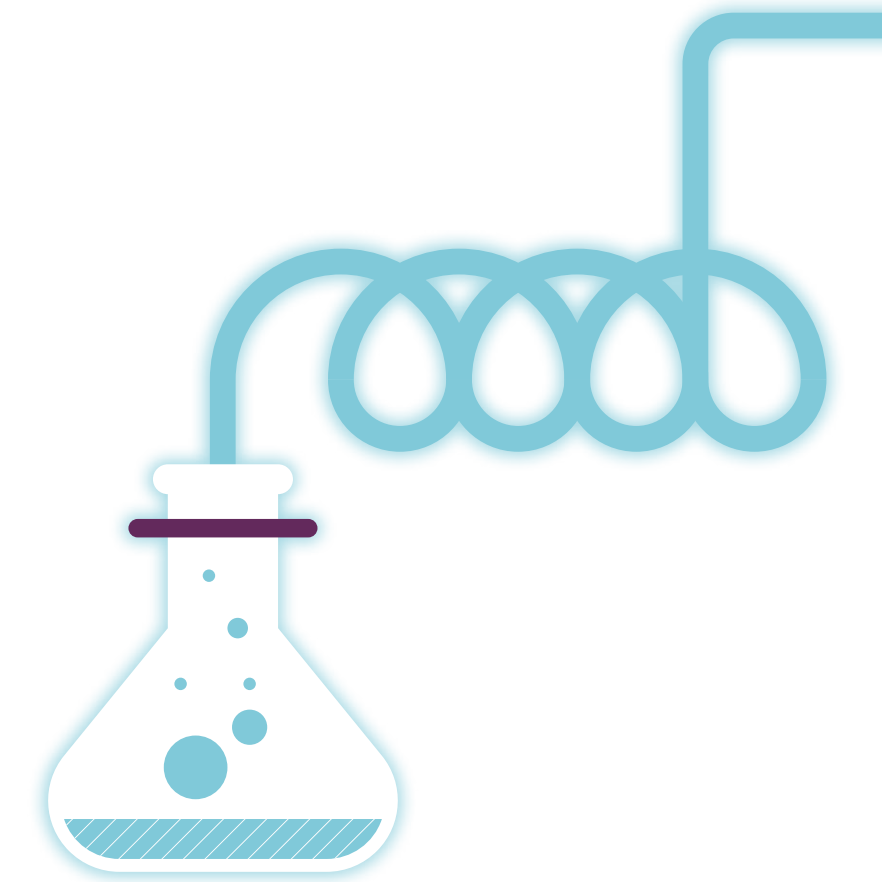
HEALTHIER INDOOR AIR

Since we spend 90% of our time indoors, the quality of the air we breathe should be of concern. A sobering fact is that indoor air in a conventional office is ten to 50 times more polluted than typical outdoor air. Green rating tools and better awareness of human health factors have provided incentives for materials used indoors to have a less detrimental impact on indoor air quality (IAQ) and even inspired innovations that help purify the air.

ADHESIVES

Construction adhesives and sealants that historically used solvents are being reformulated to emit lower levels of volatile organic compounds (VOCs). When adhesives are used over large areas, such as under carpet or tiling, the VOCs can significantly impact the health of occupants. Green buildings require that only products with low-emissions be used in interior spaces. Fortunately, there are many suppliers in South Africa offering compliant products.

Mapei, a large global manufacturer of adhesives, sealants and chemical products for buildings, lists more than 150 products that comply with the US-based LEED rating system, many of which would also satisfy Green Star SA requirements. Mapei invests 5% of its annual revenue in Research and Development, with 70% of its efforts in this sphere directed at developing products compliant with green rating



tools. At present, more than 25 Mapei products have been approved for Green Label Plus certification. This is a voluntary industry-testing program for carpet, wall coverings and flooring adhesives from the Carpet and Rug Institute, which establishes even lower emission standards than current green rating tools.

Other manufacturers offer low-VOC construction-grade adhesive and sealant products. These include but are not limited to: glazing sealants and silicones from Dow Corning; construction adhesives and interior sealants from Sika; ceramic tile adhesives from Tal and Weber-Tylon; and various similar products from the Pekay Group.

VOC ABSORBING SURFACES

VOCs found indoors stem not only from construction products, but also emanate from furniture, copiers and printers, cleaning materials and interior architectural finishes. An innovative approach to improved indoor air quality is products designed to capture and effectively remove unwanted VOCs. Gyproc has launched a new range of gypsum plasterboard and ceiling tiles called Activ'Air®. These are specifically designed to improve indoor air quality and are available in South Africa.

The technology captures and neutralises VOCs, turning them into inert, non-toxic compounds that, once trapped in the board, cannot be released

back into the air. According to the manufacturer, these boards remove 100% of aldehydes and almost completely remove other pollutants in the form of VOCs. In addition, applying water-based acrylic paint or breathable wallpaper does not affect the product's effectivity.

Independent tests found Activ'Air® reduced VOC concentration levels by up to 70%, making it a relevant choice for buildings such as schools and hospitals – both used by vulnerable groups – and in spaces like commercial offices, which are occupied for prolonged periods. Tests conducted on the product have indicated that even after multiple renovations the board continues to clean the air for 75 years.

PHASE-CHANGE MATERIALS

Can a wallboard or ceiling tile help regulate a person's thermal comfort or reduce HVAC needs? Innovative building products are employing phase-change materials (PCM) to achieve exactly this effect.

Chemistry class taught us that when a material changes phases from a solid to a liquid, it absorbs

a certain amount of energy. For example, to get an ice cube to melt (change phase to a liquid) it absorbs heat from its surroundings. Phase-change materials are chemicals specifically designed to melt and solidify at specific temperatures. In doing so, they store or release energy. When the material changes from solid to liquid and vice versa, heat is absorbed or released.

Although research on how to capitalise on this phenomenon dates back to the 1970s, the efficacy of the solutions was generally short-lived. Efforts to improve this technology and apply it to construction materials have made great strides and are now incorporated in gypsum board, ceiling tiles and wall products, to name a few.

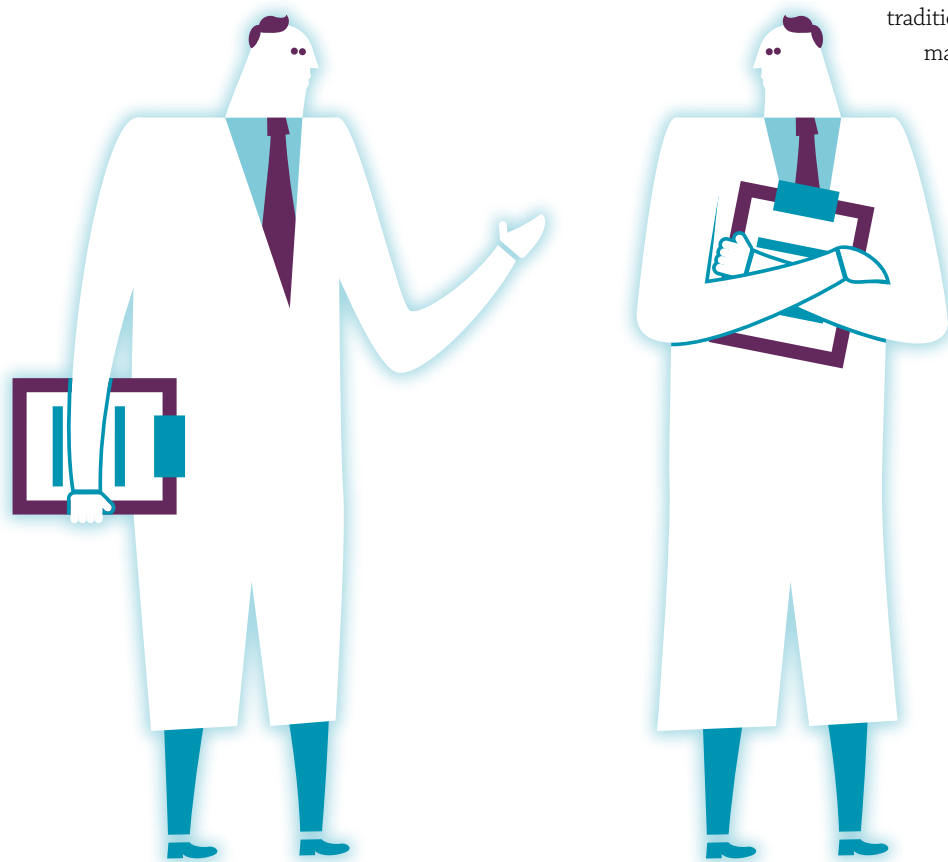
How do PCMs work? As temperatures rise during the day, heat is absorbed from the room into the PCMs, keeping the temperature comfortable for longer and delaying the onset of using air conditioning. Later when the PCMs are cooled by purging the heat through a night-cooling or mechanical ventilation design, they solidify and are thus reset for a new day's work. They can also act as a high-tech version of thermal mass storage in passive designs where traditionally brick or other mass-based materials would be used.

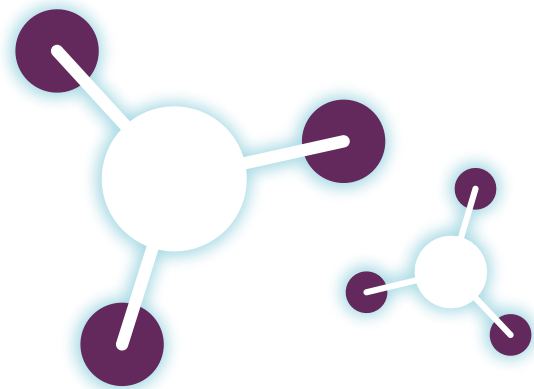
Micronal, made by BASF, is a PCM used in many commercial products. According to the manufacturer, the material has been tested in up to 10 000 phase-change cycles with no loss of performance, which equates to 30 years of use.

The material can be designed to melt at 23°C to 26°C, depending on the desired application.

PLASTERBOARD

When a PCM is in liquid form it needs to be contained. In a plasterboard product, such as Knauf PCM Smartboard, it is encapsulated in microscopic acrylic shells. These spheres are mixed with gypsum to form plasterboard. A 15 mm gypsum wallboard with Micronal PCM has a storage capacity similar to 90 mm of concrete or 120 mm of brick.





CEILING TILES

In a metal drop-in ceiling tile application such as Armstrong CoolZone, cassettes laminated against metal sheets are used to contain the material. The tiles only need to comprise 30% to 50% of the ceiling to be effective and provide a total heat storage capacity of 136 W/m². Depending on the climate it is used in, this type of technology could result in significant reductions in thermal energy of up to 6 000 kWh over a 30-year lifespan.

WALL INSERTS

Newer products feature PCMs made from abundantly available bio-based materials as opposed to petroleum-based ones. BioPCM™ from Phase Change Energy Solutions in the US is made from rapidly renewable and sustainably harvested non-food palm oil by-products as well as coconut and soy. It works on the

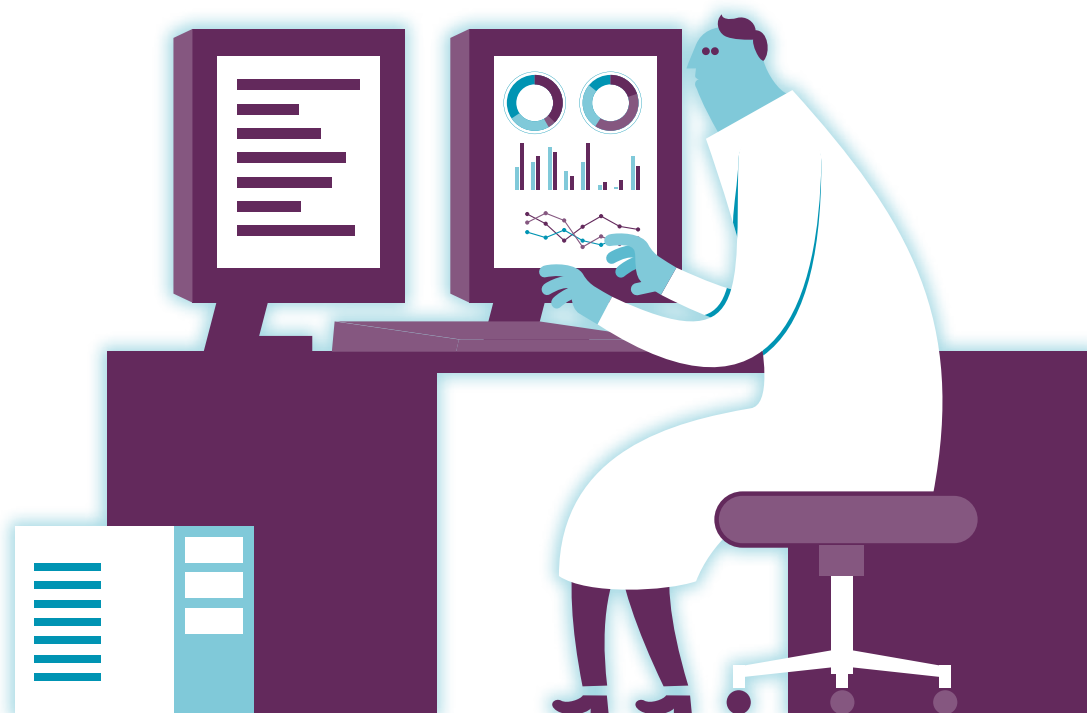
same physics principles, acts as a thermal mass as it is only 9 mm to 25 mm thick and is produced as a flexible mat that doubles as a vapour barrier in walls.

NANOTECHNOLOGY COATINGS

Nature has inspired many innovations. Two common examples of biomimicry turned into technology are the water-repelling action of the lotus leaf and the slippery surfaces of the pitcher plant. With this inspiration, emerging nanotechnology has made the creation of microscopic coatings and surfaces that help building materials perform better possible. These molecules are less than 100 nanometres thick, which is approximately 500 times thinner than a strand of human hair.

DIRT-RESISTANT GLASS

Hydrophobic nano-coated surfaces are water-repellent or allow water molecules to run off more completely. Architecturally, they were first applied to glazing. The chemical application process adds an ultra thin silicone film (a nanofilm) to glass, which substantially increases the hydrophobicity of the surface. The result is a microscopically smoother surface that is easier to clean and more resistant to weathering. Chemically, this results in fewer points of attachment for contaminants such as dirt and oils, meaning these will slip and run off when washed with water or rain. Diamon-Fusion International (DFI) offers hydrophobic coatings that create surfaces that



are water-repellent and stain and scratch resistant. They can be used on silica-based materials such as glass, porcelain, tile and granite. While typically professionally-applied to exterior building windows, the coatings can be applied to a material at the factory or on-site after installation. They can be used to reduce maintenance for shower doors, glass balustrades, mirrors and tiled walls.

PARTICLE-REPELLENT SURFACES

NanoTrac is a South Africa-based enterprise that sells “nano-coatings” among other creative endeavours for nanotechnology. The company’s Liquid Glass coating is an ultra-thin protective film created by layering silicon dioxide (SiO_2) molecules. On the nanoscale, according to NanoTrac, the material is invisible, breathable, flexible and virtually inert in nature, posing no threat to the environment or to human health. When sprayed on, the silicon dioxide molecules bond to the application surface by electrostatic forces because they are extremely small in relation to the surface. An

advantage is that no synthetic chemical agents are required to bring about the bonding; it uses quantum forces and can be applied to a

variety of materials. The nano glass layer causes a water-repellent effect that prevents dirt, microbes and any other particles from adhering to the surface. The result is a non-stick, easy to clean and more

hygienic surface. Some construction applications include preservation of interior and exterior surfaces such as wood and stone, algae and mould protection, graffiti resistance, textile stain prevention and sanitation of food preparation and fitness club surfaces.

HIGH-PERFORMANCE PAPER

Waste paper is being reinvented into a high-performance product. PaperStone® is a solid surfacing material made from recycled paper saturated with a proprietary phenolic resin and natural pigments for colour. Phenolic resin and paper composites have long been known to have

superior tensile, compression, impact and flexural strengths. The manufacturer highlights that “it has steel-like strength in span, stone-like beauty and it can be worked like fine hardwoods”.

PaperStone® is certified by the Forest Stewardship Council (FSC), does not contain added urea-formaldehyde and is free of VOCs, giving it the potential to contribute to green rating tool credits. Due to its environmentally-conscious production process, the manufacturer indicates further resource savings when compared to a traditional phenolic composite manufactured from virgin fibre and a commercially available resin. Based on EPA calculator data, PaperStone®’s process saves: 4 667.4 litres of water, 595 kWh of energy, 59.4 kg of solid waste, 115.2 kg of greenhouse gases and 25 kg of petroleum-based phenol.

To create the material, multiple layers of 100% FSC-certified post-consumer recycled paper are stacked depending on the desired finished thickness. Once saturated with phenolic resin, the sheets are fused together under heat and pressure. This cross links the resin polymer in three directions, producing a dense, homogeneous and essentially non-porous composite product that does not delaminate. Ordinary paper is transformed into an extremely strong and durable solid surface material with incredible longevity and resistance to water.

The non-porous surface is extremely rigid and dense, providing stain-resistance and absorbing virtually no water. It is also heat-resistant and certified as food safe. The primary application is as countertops but it also lends itself to additional applications such as furniture, tables, vertical panels, toilet partitions and can be CNC-routed for signage. While it is produced in the United States, it is imported and available in South Africa from STONETECH.

Market changes will continue to fuel product innovation in more sustainable materials for interiors and construction in general. The selection currently available already offer specifiers some interesting alternatives to the norm. 