RUMOER

A(BouT) Building Technology

featuring

MANUFACTURA, NPSP BV, Veena Sahajwalla,
Dr.Faidra Oikonomopoulou & Dr.Telesilla
Bristogianni , Sam Lonis and ROTOR

BT Spotlight featuring

CORE Studio - Dr. Serdar Aşut ,Project RED,
DSS SARO & SeismoSolve,
User centered sustainability Studio -
Dr. Craig Martin & Designing together

85. Waste Streams

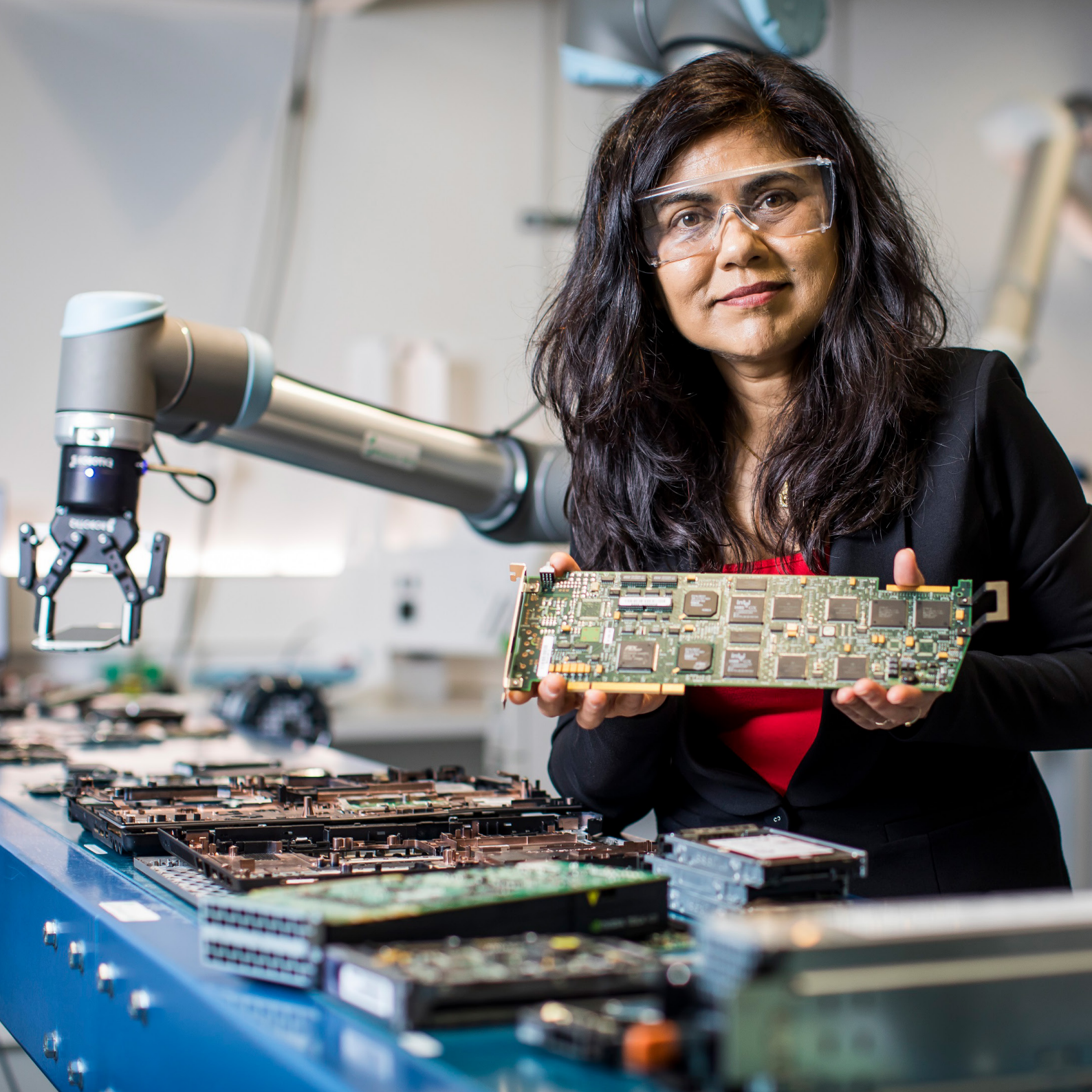
Cover page

NABASCO® 8010

The cover image shows a bio-composite material by NPSP BV made from reed and Recell® (recycled cellulose) fibers, which are recovered by the Dutch water boards and would otherwise be burned or composted.

NPSP develops and supplies innovative environmentally friendly composite materials and products for public space, construction, design and mobility. They use bio-based and circular raw materials as much as possible, which can be reused after a long life cycle.

NPSP BV
https://www.nabasco.nl



WASTE AS A RESOURCE FOR SUSTAINABILITY & DECARBONISATION

Veena Sahajwalla

Recovering valuable materials from wastes not only creates greater sustainability but introduces new capability to support wider manufacturing (and sovereign) needs. It also creates more skilled jobs, and delivers overall economic, social and environmental benefits, compared to only using virgin materials.

Our current overconsumption of resources is more than planet Earth can sustain in the medium to long term. Making sure that our actions today do not have an adverse effect on the potential of present and upcoming generations to exist comfortably on this planet is the essence of sustainability.

Fig. 1: Professor Veena in the UNS SMaRT Centre's E-waste MICROfactorie. © Anna Kucera

QR1: SMaRT @ UNS

The challenge is very much one of incorporating emerging recycling technologies, like the various ones developed by our UNSW Sustainable Materials Research and Technology (SMaRT) Centre, into future manufacturing challenges to help make sure we can fulfill our requirements in ways that are financially viable, environmentally responsible and benefits communities.

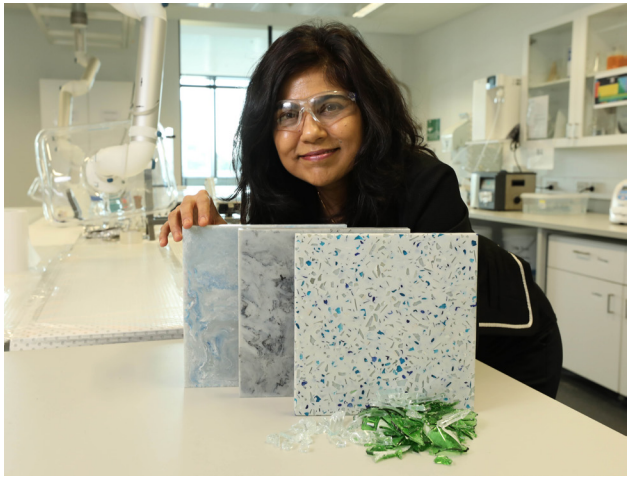


Fig. 2: Veena with Green Ceramic tiles made from waste textiles and glass.

Fig. 3: Chairs and a table made from SMaRT's Green Ceramics.

A wasteful society

Statistically, Australia is one of the most wasteful developed nations, second only to the United States of America in terms of per capita plastic bags consumption.

On average, each Australian consumes over 24kg of plastic and uses over 230 plastic bags every year. In 2020, only 13% of the plastic waste was recycled and 84% going into landfill. The rest ends up in waterways and the oceans, which the 2021 The National Plastics Plan (NPP) estimates to be at 130,000 tonnes every year. This is equivalent to 1,280 kilograms of plastic being dumped every hour in Australia's ocean.

Australia is also increasingly challenged by complex e-waste. Australian Bureau of Statistics' latest waste estimate figures show the Australian economy generated 539,000 tonnes of e-waste in 2019, with more than 50% going to landfill and only 17.4% being 'claimed as recycled'. Although much of the 'claimed as recycled' product goes offshore where outcomes are unknown.

Australian traditional recycling facilities are limited to pre-processing or partial mechanical processing which can separate, dismantle or shred only. There are limited decentralised technologies for the effective isolation of the valuable metal alloys, REEs (rare earth elements) and critical metals contained in e-waste.

Valuable and much needed materials going to landfill

Many materials needed for future electrification and manufacturing components are subject to supply and price constraints, not to mention the environmental impacts of virgin mining, transporting and processing raw resources.

Yet we are landfilling waste containing many of these valuable materials needed.

We know that over the coming decades all of our global natural resources will not be sufficient to supply future manufacturing needs, including to electrify the world.

So, it is clear we urgently need advanced solutions to supply recycled waste materials as feedstock resources for future manufacturing needs, thus helping to truly create circular economies and sovereign capability.

Reforming complex waste to manufacturing feedstock

There are emerging technologies that can reform various hard to recycle or complex wastes into new value-added products and manufacturing feedstock, and our various UNSW SMaRT Centre-designed technologies attest to this.

Best known of these technologies is SMaRT's Green SteelTM Polymer Injection Technology, which is well known for using millions of waste rubber tyres destined for landfill as an alternative source for partial replacement coke and coal (carbon) in electric arc furnace steel making.

The next generation of Green SteelTM research now shows waste plastics and bio-waste like coffee grounds are also effective and contain hydrogen which improves the efficiency of steel making. This technology locks the carbon from waste resources into the steel, hence causing no emissions and delivers a form of carbon capture while diverting millions of tyres from landfill.

SMaRT's various MICROfactorieTM Technology modules are now in various stages of R&D and commercialisation, tackling hard to recycle wastes through small but scalable MICROfactoriesTM that can recover the valuable materials of these waste and reform them into new products or as feedstock for new manufacturing.

The Green Ceramics modules reforms waste textiles and problematic glass, plastics and other materials into a wide range of ceramics for the build environment, while the Plastics Ecofilament modules which reforms toner cartridges, and a range of e-waste plastics not being recycled, into filament for 3D printing and manufacturing.

The E-waste module recovers valuable E-materials

Some recent work has involved developing a new module to create a demonstration battery recycling MICROfactorieTM capable of dismantling spent batteries, including those made of alkaline and lithium for re-use.
And in a new partnership we have with a regional metal can manufacturer for our Green Aluminium MICROfactorieTM technology.

The UNSW SMaRT Centre's aluminium recycling technology will be used to enable our partner become one of the first aluminium aerosol can producers in the world to make aerosol cans from waste currently not recycled because it contains mixed materials including plastics.

In another SMaRT Centre scientific breakthrough, a new process has been developed that could pave the way for the manufacturing of a new breed of batteries to help meet decarbonisation goals. Results from a UNSW SMaRT Centre scientific paper demonstrate that recovered carbon from automotive waste can be used as a vital ingredient (anode active materials) for sodium ion batteries.

Finding a sustainable purpose

Diverting waste so it can become a resource for future manufacturing needs, particularly that related to making all of the electrical components needed for electrification, will help Australia and the world achieve its ambitions around decarbonisation, clean energy and creating circular economies.

With the right will, society can find a purpose for most waste by understanding the elemental value inherent in it. This can only be done through rigorous scientific analysis and active collaboration with industry, the community and governments to ensure innovations are taken up and used.

By better valuing our waste materials and creating circularity for their reuse, we can help the world be more sustainable and tackle our big global challenges.

Fig. 4: Veena undertaking metallurgical reactions in a laboratory furnace.

Veena Sahajwalla
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Professor Veena Sahajwalla is a material scientist, engineer, and inventor that is revolutionising recycling science. She is the Director of the UNSW Sustainable Materials Research and Technology (SMaRT) Centre, and the inventor of polymer injection technology Green SteelTM; an eco-friendly process for using recycled tyres and other wastes in steel production. Veena launched her MICROfactoriesTM, the first of it's kind, in 2018 and is the Director of the ARC Microrecycling Research Hub, as well as Leader of the National Environmental Science Program's Sustainable Communities and Waste Hub, and the 2022 NSW Australian of the Year.