



Australian Government

THE PRIME MINISTER'S PRIZES FOR SCIENCE



COLIN HALL

PRIZE FOR NEW INNOVATORS



Creating new manufacturing jobs by replacing glass and metal with plastic

Dr Colin Hall and his colleagues have created a new manufacturing process that

will allow manufacturers to replace components made from traditional materials like glass, in cars, aircraft, spacecraft, and even whitegoods—making them lighter and more efficient.

Their first commercial success is a plastic car wing-mirror. The Ford Motor Company has already purchased more than 1.6 million mirror assemblies for use on their F-Series trucks. The mirrors are made in Adelaide by SMR Automotive and have earned \$160 million in exports to date. Other manufacturers are assessing the technology. And it all started with spectacles.

Colin used his experience in the spectacle industry to solve a problem that was holding back the University of South Australia team's development of their new technology. He developed the magic combination of five layers of materials that will bind to plastic to create a car mirror that performs as well as glass and metal, for a fraction of the weight.

For his contribution to creating a new manufacturing technology, Dr Colin Hall from the University of South Australia receives the inaugural Prize for New Innovators.

Plastics have transformed the spectacles industry. Fifty years ago spectacles were heavy and broke easily. Today most spectacles are light, strong, water repellent, scratch resistant, and anti-reflective. The transformation is due to the use of plastic lenses coated with layers of materials that provide the necessary properties. Critically for the invention of the plastic car mirror, Colin worked as a researcher for nine years with SOLA, the Adelaide-founded company that pioneered the replacement of glass in spectacles.

Car manufacturers are continually working to reduce the weight of their cars and to use less toxic manufacturing processes. Replacing the shiny metal components on cars with plastics is an obvious place to start. Plastic is lighter and easier to shape and manufacture, and making a plastic mirror is not difficult. But making a plastic mirror that will perform year after year in the Arizona desert or a Swedish winter is much harder. Car-makers will only commit after an extreme testing regime that demonstrates that a new component will perform for the life of the car.

Colin studied plastic components already on the market. He found that the mirror coatings had poor surface finish, and the metal layer was weakly bonded to the plastic so that it would inevitably fail when exposed to heat, cold and UV. Inspired by his work on spectacles, Colin developed a new approach that involves:

- a resin layer that coats the plastic and removes imperfections in the moulding
- a silicon dioxide layer that reduces temperature stress and abrasion
- a chrome alloy layer that acts as the mirror, and also reflects UV
- another silicon dioxide layer for abrasion resistance
- and a water-repelling layer for easy cleaning and defrosting.

The combination delivers a highly reflective, shatterproof, long-lasting mirror. Its invention is the subject of five patents.

The underlying technology will also make factories safer. Electroplated chrome plastics are currently used for many metal-like plastic parts from car badges to 'stainless steel' fridge handles. This technology is being phased out in the European Union because of carcinogens used in production.

The inventions of Colin and his colleagues at the University of South Australia's Future Industries Institute have already created new manufacturing jobs in Adelaide. There could be many more as their new manufacturing technology is applied across industry.



Career profile, Dr Colin Hall

QUALIFICATIONS

2014	PhD (Minerals and Materials), University of South Australia	2011–2014	Research Fellow, Mawson Institute, University of South Australia
1994	Bachelor of Applied Science (Honours) (Applied Physics), University of South Australia	2011	Automotive Engineering Excellence Award (Silver), Society of Automotive Engineers, Australia
1993	Bachelor of Applied Science (Applied Physics), University of South Australia	2011	Research Excellence Award, AutoCRC
		2009–2014	Chief Investigator, Nanohardness properties of human enamel, Australian Dental Research Foundation

CAREER HIGHLIGHTS

2015–ongoing	Senior Research Fellow, Future Industries Institute, University of South Australia	2008–2011	Research Fellow, Ian Wark Research Institute, University of South Australia
2015	GM Holden scholarship, Governor's Leadership Foundation program	2004–2009	Research Fellow, Centre for Advanced Manufacturing Research, University of South Australia
2014-ongoing	Secretariat, SA Branch of Materials Australia	1995–2004	Research Physicist, SOLA International Holdings Research Centre
2014–2016	Chief Investigator, Low cost heliostat, Australian Solar Thermal Research Initiative		
2012–2017	Chief Investigator, Next generation automotive coatings, AutoCRC		
2012	Best PhD Student seminar, Ian Wark Research Institute		
2012	Ford made the SMR plastic convex spotter mirror standard in F350 and F250 models		
2011–2015	Technical Advisory Committee, Society of Vacuum Coaters		

Further reading

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