



DIVISION OF POLYMERIC MATERIALS: SCIENCE & ENGINEERING

Roy W. Tess Award

2021 Award Winner

Dr. Shanti Swarup
PPG



Dr. Swarup, Life-long PPG Collegium Member, has been a highly valued contributor to PPG's success for 32 years, with his entire career focused on developing and commercializing novel polymer architectures for the coatings industry. He and his team have developed 220 unique polymers of which 55 are used in commercial coatings. He is named inventor and author on over 600 global patents and publications including 92 granted U.S. Patents and over 20 patents pending review. The polymers described in these patents are used in commercial coatings resulting in over \$9 billion in cumulative sales to PPG and address important issues such as worker safety, reduction in CO₂ and VOCs, waste minimization, improved productivity, performance, and economy.

Dr. Swarup was a key contributor to the success of PPG's B1:B2 compact process which stands for basecoat one, basecoat two, applied wet-on-wet. B1:B2 eliminates a curing step and was first commercialized by BMW in England and then implemented at their assembly plant in South Carolina in 2010. This technology enabled BMW to cut energy consumption at this plant by 30%, reduce CO₂ emission by 43%, VOC (Volatile Organic Components) by 7% and reduce process time by 30%. He developed the polymer structures that enabled control of the rheology of the various layers, which in turn controlled the amount of mixing that occurs between the layers. This is important for the overall appearance of the coating stack, as well as the physical properties of the cured film. This technology is now used globally not only at BMW but also at many other automakers.

Dr. Swarup recognized that N-methyl pyrrolidone (NMP) solvent would be regulated out of coatings once being classified as a CMR (carcinogenic, mutagenic, reprotoxic) substance by the European Union. NMP was the traditional solvent used to make polyurethanes. It is both polar and aprotic with strong solvating power which makes it extremely difficult to replace. He successfully developed several NMP-free polymers, which required substantial polymer changes and fundamental understanding, for the automotive industry that have since generated multi-billion dollars in sales for PPG. Since this success, other project teams wishing to remove NMP from their product lines have reached out to him for his expertise. For example, he is named inventor on the recently published patents for NMP-free lithium-ion battery electrode binder (US 10,033,043 and US 9,385,374) that has the potential to change the environmental footprint of battery manufacturing, removing toxic solvent waste and enhancing worker safety.

Dr. Swarup and his team developed polymers which are used in automotive Audioguard. Audioguard is a waterborne, spray-applied coating that provides vibration dampening and reduces vehicle noise. It replaces manually applied polyurethane foam pads and significantly reduces the labor required to apply the coating. This

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technology is the bench- mark in the industry and used by global-automakers. Another testament to his polymer expertise is in the breath of the end markets his polymers serve, along with the corresponding range of performance properties. He has successfully designed both solvent-borne and waterborne acrylics, polyesters, polyurethanes, and other non-traditional coating polymer chemistries for such diverse applications as high-speed metal coil lines, automotive refinish, packaging, and coatings for polycarbonate optical lenses.

He was the recipient of the 2008 PPG President's Award for developing acid etch resistance clear coat technology. The President's Award is the highest honor PPG grants to project teams. He was inducted to the life-long PPG Collegium, an organization of PPG Innovative leaders in 2016, the highest honor given to any PPG employee. His research inventions have been presented at numerous global conferences. For example he was the synthesis team leader for the technology recognized as a SURCAR Award winner in conjunction with Daimler for easy-to- clean coating in 2015, and R&D 100 and Surcar Conference Award for high performance primer layer which eliminates 30% CO₂ emission in 2017, and ACS Hero of the Chemistry in 2019.

He received 2018 ACS-National Award in Applied Polymer Science, and was named ACS POLY Fellow and ACS PMSE Fellow in 2020. He has maintained active participation in ACS for more than 35 years at the local and national level and served on the Industrial Advisory Board of the Polymer Division for past 10 years. He co-chaired a symposium on new crosslink chemistry at the 2019 Spring National meeting of ACS in the PMSE section.

He was recognized by PIPLA (Pittsburgh Intellectual Property Law Association) as 2020 Inventor of the year.

Dr. Shanti Swarup will receive the Tess Award from Dr. Tim Bunting, Chair of the PMSE Division, in August 2021 during the 262nd National Meeting of the American Chemical Society in Atlanta, GA. An evening reception in honor of the Tess award recipient and other PMSE and POLY award winners also will be held at the ACS meeting.