



Joseph M. DeSimone

Stanford University

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Joseph M. DeSimone is the Sanjiv Sam Gambhir Professor of Translational Medicine and Chemical Engineering at Stanford University. He is the Co-Director of Canary Center, the founding Faculty Director of the Center for STEMM Mentorship, and the Vice Chair of Strategy in the Department of Radiology. He also holds courtesy appointments in Chemistry, Materials Science and Engineering, and Stanford's Graduate School of Business. Previously, DeSimone was a professor of chemistry at the University of North Carolina at Chapel Hill and of chemical engineering at North Carolina State University. He

is also Co-founder, Board Member, and former CEO of the additive manufacturing company, Carbon. DeSimone has published 400+ scientific articles and is a named inventor on approximately 250 issued patents. He has mentored 86 students through PhD, half of whom are women and members of underrepresented groups in STEM. DeSimone has received numerous recognitions for achievements in science, engineering, invention, and business, including the U.S. National Medical of Technology and Innovation, Presidential Green Chemistry Challenge Award; the American Chemical Society Award for Creative Invention; the Lemelson-MIT Prize; the NIH Director's Pioneer Award; the AAAS Mentor Award; the Heinz Award for Technology, the Economy and Employment; the EY Entrepreneur of the Year Award (2019 U.S. Overall Winner); and the Harvey Prize in Science and Technology. He is an elected member of the American Academy of Arts and Sciences and all three branches of the U.S. National Academies (Sciences, Medicine, Engineering). DeSimone received his B.S. in Chemistry from Ursinus College and his PhD in Chemistry from Virginia Tech.

Abstract: "The Delicate Interplay Between Light, Interfaces and Design To Scale 3D Printing"

The production of polymeric products relies largely on age-old molding techniques. In this talk, I will describe a breakthrough in additive manufacturing—3D printing—referred to as Continuous Liquid Interface Production (CLIP) technology (Science 2015). CLIP, and its recently introduced cousin injection CLIP (iCLIP; Science Advances 2022), embody a convergence of advances in software, hardware, and materials to bring the digital revolution to the design and manufacturing of polymeric products. CLIP uses software-controlled chemistry to produce commercial quality parts rapidly and at scale by capitalizing on the principle of oxygen-inhibited photopolymerization to generate a continual liquid interface of uncured resin between a forming part and a printer's exposure window. Instead of printing layer-by-layer, this allows layerless parts to 'grow' from a pool of resin, formed by light. Compatible with a wide range of polymers, CLIP opens major opportunities for innovative products across diverse industries. Previously unmakeable products are already manufactured at scale with CLIP, including the large-scale production of running shoes by Adidas (Futurecraft 4D); mass-customized football helmets by Riddell; the world's first FDA-approved 3D printed dentures; and numerous parts in automotive, consumer electronics, and medicine. At Stanford, we are pursuing new advances including digital therapeutic devices, new multi-material printing approaches, and the design of a high-resolution printer to advance technologies in the microelectronics, electrodes for batteries and electrocatalysis, intradermal drug/vaccine delivery, and pain-free, minimally-invasive approaches for interstitial fluid sampling to enable low-cost liquid biopsies.