

Institute for Advanced Study *Distinguished Speakers Series*



Cars: Chemistry in Motion

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Abstract:

When it comes to getting from here to there, chemistry is essential, whether it be a trip to the local store to buy groceries or a shot into space to explore the Universe. Cars, for example, are truly chemistry in motion. Today's automobile relies heavily upon chemical industry innovations to enhance performance, to provide safety for its occupants, and to deliver fuel efficiency. On average, each car contains nearly 2,000 U.S. dollars worth of chemical processing and products. These items range from its scratch-resistant paint job, to its often lightweight plastic-molded frame, to its shatter-resistant polyvinyl butyral (PVB) layered windshield, to its soft polyurethane seat cushions, to its neoprene hoses, break fluids, sealants, adhesive, and coolants, to its chemically powered airbags, to its styrene-butadiene tires with added stabilizers and antioxidants. Chemistry really keeps people moving!

Chemistry also is addressing the environmental issues facing today's automotive industry. For example, the replacement of steel with high-strength engineered plastics has enabled cars to become lighter, which boosts fuel efficiency and reduces emissions without sacrificing safety. Nevertheless, more needs to be done, as I will try to explain. Each gallon of gasoline, which weighs 6.3 lbs. produces 20 pounds of carbon dioxide when burned. The extra weight comes, of course, from the oxygen that combines with the carbon in the fuel to make carbon dioxide. In the United States, something like 400 million gallons (1.51 billion liters) of gasoline gets consumed every day. This figure translates to about 146 billion gallons (about 550 billion liters) of gasoline per year, which yields the annual release of about 290 billion pounds of carbon dioxide into the atmosphere. It is no wonder then to find that more than two-thirds of U.S. oil consumption is used for transportation, which accounts for about one-third of all U.S. CO₂ emissions. This talk will emphasize the challenge of cutting carbon dioxide emissions to reduce the risk of incurring severe global climate change.