



## Materials research and white-knuckle air travel

I have been supporting *MRS Bulletin* this year as one of the 2012 Volume Organizers and it has been an interesting process. Two of the theme issues that I helped to commission are connected to air travel.

The first was on Plasmonics that appeared in the August issue. The Guest Editors were Jennifer Dionne of Stanford University and Harry Atwater of the California Institute of Technology. I have known Harry for many years through our volunteer activities with the Materials Research Society. The theme issue came out of a discussion that Harry and I had on a flight from Boston to Los Angeles after the Fall Meeting of 2010, when I knew that I would be a Volume Organizer, but before work on the 2012 volume had actually begun.

Harry was in the row behind me. We discussed a variety of possible hot topics for theme issues, including the one on plasmonics which he was willing to do with Jennifer. I put that on my list of topics to discuss during the Volume Organizer meetings and it was chosen as one of our themes. It is possible that we, the 2012 Volume Organizers, would have arrived at this theme independently of that flight, because plasmonics *is* such a hot topic with potential applications across a broad range of technologies. However, it is also possible that we would have chosen one of the other candidate topics that did not make our final list.

The other theme topic connected to air travel is Thermal-Barrier Coatings for Gas-Turbine Engines that appeared in the October issue with David R. Clarke of Harvard University, Matthias Oechsner of Technische Universität Darmstadt, and Nitin P. Padture of Ohio State University as Guest Editors. This one is explicitly connected to air travel in that the thermal-barrier coating applications discussed included those for turbine engines in jet aircraft. That connection became somewhat more real for me on a recent flight from Los Angeles to Little Rock, Arkansas, in August.

I am a “white-knuckle” flier. I always have been, and probably always will be. There are no nonstop flights from Los Angeles to Little Rock. Most of the connecting airports are in the southwest of the United States. On this day, our intermediate stop was in Phoenix, Arizona. As we began our descent into Phoenix, the pilot came onto the intercom advising

everyone (including the flight attendants) to take their seats for the remainder of the flight, because Phoenix was experiencing a sandstorm and that we would likely be flying through some amount of airborne sand on our way to landing.

Now, ordinarily that would be enough by itself to significantly concern me, but one of the manuscripts included in the theme issue was an excellent article by Carlos G. Levi, John W. Hutchinson, Marie-Hélène Vidal-Sétif, and Curtis A. Johnson on “Environmental degradation of thermal-barrier coatings by molten deposits,” which discusses catastrophic systems failure when thermal-barrier coatings are breached by deposits including silicates (sand!). I had just completed my review of that manuscript and had returned it to the *Bulletin* editorial staff with my suggestions for changes a day or two before my flight.

Needless to say, on both landing and taking off from Phoenix that day, every bounce and bump of the aircraft was magnified in my imagination. It is also needless to say that nothing catastrophic happened, because I am actually here to write this POSTERMINARIES. Nonetheless, it confirms that a little knowledge and a highly active imagination can be an unsettling thing.

It also confirms for me the value provided by materials research in this area. There are tens of millions of commercial airline flights every year. Many of the flights are into environments or conditions as bad or worse than the one I flew through in Phoenix. And yet, travel by aircraft is by far touted as the safest mode of transportation. I do not believe that this would be possible without the investments made in materials research for aircraft frames, skins, and propulsion systems.

By the way, I know that neither the pilots nor air traffic control would have allowed us to fly if they believed there was serious risk. That is cold intellectual comfort, but little actual comfort to us white-knuckle fliers.

Aircraft manufacturers are incorporating advanced materials and designs to make flights more fuel efficient, quieter (less engine noise), and less sensitive to turbulence. I doubt that I will ever be anything but a white-knuckle flier, but future flights on some of the newer aircrafts such as the Boeing 787 Dreamliner and the newer Airbus systems such as the A350 XWB that incorporate some of these advances may reduce my angst.

**Steve Moss**