WHAT IS RHEOLOGY ANYWAY?

By Dr. Faith A. Morrison

Reprinted from *The News and Information Publication of The Society of Rheology*,
Vol. 73, No. 1, January 2004

When the hotel clerk at The Society of Rheology Meeting asks me "What is rheology anyway?" I have a ready answer I could use: "Rheology is the study of deformation and flow." This is true, but such an answer would not usually be followed by a light bulb moment for the friendly staff member.

Instead, I say: "Rheology is the study of the flow of materials that behave in an interesting or unusual manner. Oil and water flow in familiar, normal ways, whereas mayonnaise, peanut butter, chocolate, bread dough, and silly putty flow in complex and unusual ways. In rheology, we study the flows of unusual materials."

"Oh,"the desk clerk replies. "Interesting. I thought it might be something to do with religion or something—rheology, theology—it's so similar.

"True. It's a common mix-up. Especially for me, since my name is Faith." We both smile.

I have even had the experience of explaining rheology to the guests at a wedding reception. "Oh, you're writing a book, says Patankar, a theater director and friend of the bride. What is it about?"

"It's a college textbook called *Understanding Rheology*." Then the predictable question: "What's rheology?"

Since we had time before the dancing resumed and Patankar appeared to be truly interested, I went beyond the desk-clerk version and explained a bit more about rheology.

"You know how with mayonnaise, when you first open the jar there's a little curl of mayo at the top, left over from when the jar was filled, months or years ago. Or when you open a partly used jar of mayonnaise, how the shape of the top surface is distorted by whoever last made a sandwich."

"True," said Patankar.

"Well, compare that observation with the behavior or honey. The top surface of honey in a jar is always smooth. Within a few seconds of serving yourself from a honey jar, the surface is flat again—it is able to flow and become flat quite rapidly, while the mayo, even after months, fails to flow, and retains the last shape carved into it by a knife."

"That is odd," Patankar concurs. "What's the difference between mayo and honey? If anything, honey seems thicker to me than mayonnaise, so the honey should have a harder time flowing than the mayo."

"Good observation. You've just noticed a key point about studying unusual flow behavior. Normal fluids can be different in the sense that some are thicker than others—in scientific terms some fluids have higher viscosities than others. But other than having different viscosities, all normal or Newtonian fluids (air, water, oil, honey) follow the same scientific laws. On the other hand, there are also fluids that do not follow the Newtonian flow laws. These non-Newtonian fluids, for example mayo, paint, molten plastics, foams, clays, and many other fluids, behave in a wide variety of ways. The science of studying these types of unusual materials is called rheology—*rheo* from the Greek word for 'flow,'and *-ology* meaning 'study of'."

Anyone who has cooked or baked or played in a sandbox or in a bubble bath has experimented with rheology. The scientists who study the mathematical relationships that describe the behavior of non-Newtonian fluids are called rheologists, and 1700 of them from around the world are members of The Society of Rheology (SOR; on the Web at www.rheology.org/sor/), a founding Member Society of the American Institute of Physics (AIP). SOR was officially formed on December 9, 1929, the outgrowth of a burgeoning interest in the behavior of colloidal materials, including interest in the flow behavior of newly discovered synthetic rubbers and polymers.

The object of the Society of Rheology is the advancement of rheology and its applications, and to that end, the SOR sponsors yearly meetings and publishes the *Journal of Rheology* and the *Rheology Bulletin.* [*The Journal of Rheology*, a peer-reviewed scholarly publication, appears six times a year; its editorial production is done through AIP.]

Dr. Faith A. Morrison is Associate Professor of Chemical Engineering, Michigan Technological University. She is the author of *Understanding Rheology* (Oxford, 2001), is currently editor of the *Rheology Bulletin* and member and past chair of the SOR Membership Committee.