Symbol:	5P4E	
Type:	Five-ring Polyphenyl Ether	
Source:	Monsanto Company	
Properties:	Viscosity at 37.8C, m^2/s	363×10^{-6}
	Viscosity at 98.9C, m^2/s	13.1×10^{-6}
	Density at 22.2C, Kg/m^3	1205
	Density at 37.8C, Kg/m^3	1190
	Flash Point, C	288
	Pour Point, C	4.4

Symbol:	Santotrac 50	
Source:	Monsanto Company	
Type:	Synthetic Cycloaliphatic Hydrocarbon Traction Fluid	
Properties:	Viscosity at 37.8C, m^2/s	34×10^{-6}
	Viscosity at 98.9C, m^2/s	5.6×10^{-6}
	Pour Point, C	−37
	Density at 37.8C, Kg/m^3	889
	Flash Point, C	163
	Fire Point, C	174
	Specific Heat at 37.8C, J/Kg·K	2332
	Additive package includes: Antiwear (zinc dialkyl dithiophosphate), Oxidation inhibitor, Antifoam, VI Improver (Polymethacrylate).	

DISCUSSION

James L. Lauer[2]

This paper is another contribution from Winer's group in support of the proposition that it is the maximum yield shear stress (MYSS) of the amorphous solid formed in the elastohydrodynamic (ehd) contact, which determines the maximum traction. The MYSS is indeed a material property shown related to the traction behavior of some of the known fluids. The experimental methods described are simple and ingenious and not too different from those established in polymer research. They appear to be very well suited for the purpose.

The measurements—essentially dilatometry in an annular space around a sealed piston—appear to be a function of both the interfacial forces (fluid/metal) and the cohesive forces of the fluid. Indeed, both are involved in an actual ehd situation, so that the measurements are representative. Perhaps the very low shear stress obtained for dimethylsiloxane is a result of its unusual wetting behavior. Changing the surface/volume ratio of the test sample space could help separate the interfacial from the cohesive effects, or calibrations could do so.

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It would seem to me that these effects must be related to each other for maximum traction (large adhesive forces without sufficient cohesion in the lubricant would cause failure). Once these influences on traction are understood, intelligent selection of materials on the basis of chemical structure can be made. In this connection, it should be pointed out that a large body of such information already exists in the related field of polymer science.

In a way, Professor Winer's view of traction—a continuous glue resisting shear separation of the parallel surfaces it separates is the opposite of Professor Cameron's—discrete granules. Since the resistance to dilatation of an amorphous material is considered to be a result of interlocking molecular segments, the difference between these views is not as fundamental, as it would appear, but is primarily one of scale. In any case, we have come a long way in our understanding of traction phenomena.

Author's Closure

The authors appreciate Dr. Lauer's thoughtful discussion of our paper. We believe that the low value of the shear stress of the dimethylsiloxane material is probably not due to low adhesion between the siloxane and the metal chamber, because the geometry of the shearing section does not permit slippage of the sample against the cell wall.