

On Slippery Ice

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Abstract

Sliding on ice is a familiar experience, but the reason why ice has such a low friction has a long and controversial history. For many years, it has been assumed that the main reason for the low friction of ice is due to the formation of a thick lubrication layer of melt water. However, there is no consensus on the origin of the melt water film. Among the different hypothesis enumerated are pressure melting, ice premelting and frictional heating of the surface [1]. Very recently, however, it has been suggested that lubrication plays no role whatsoever, and that ice friction is mainly given by adhesive and mechanical properties of ice [2].

Unfortunately, these hypothesis cannot be easily confirmed by macroscopic experiments. What is the actual thickness of the watery lubrication film under static conditions? Does it change significantly with the nature of the substrate? Does it become thicker upon increasing the pressure or shearing? Is the resulting thickness sufficient for the establishment of a lubricating Couette flow?

In this work we borrow tools from our recent investigations on the structure of ice premelting in order to understand better the microscopic origin of the low friction coefficient of ice [3-5].

REFERENCES

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FIGURES

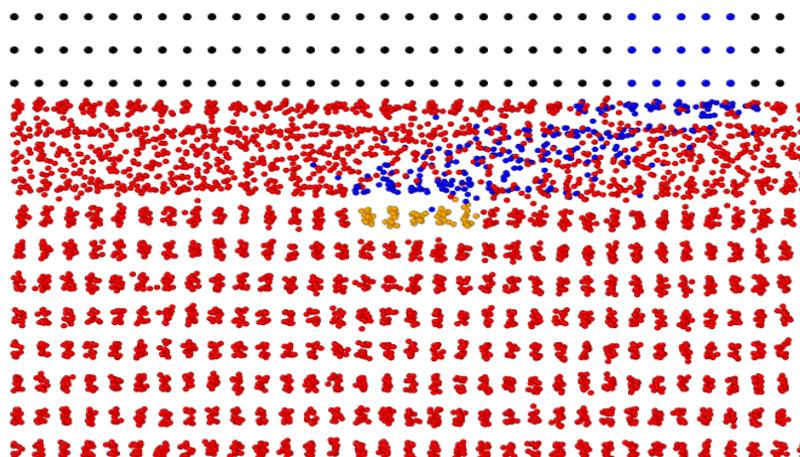


Figure 1: Flow pattern of an interfacially premelted ice film upon shearing by a slider. How close is this to macroscopic Couette flow ?