Slider-Lubricant Interactions and Lubricant Distribution for Contact and Near Contact Recording Conditions

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Abstract

Lubricant distribution and recovery for near contact and contact recording conditions are experimentally investigated using Thermal Fly-height Control (TFC) sliders. Contact between the protruded center pad and the disk lubricant causes a thickness modulation (rippling) together with lubricant depletion that grows with contact duration. Slider dynamics and lubricant rippling evolve quickly in the first few revolutions of contact and rippling frequencies are strongly correlated with the slider air bearing frequencies. Peculiar cases where suppressed ‘stable’ slider dynamics occur for TFC heater power beyond the touchdown power correspond to negligible lubricant rippling and this condition may be sustained for fairly long durations in some tests. Experiments with different lubricant types (ZTMD, Z-tetraol+A20H, Z-dol+A20H) and different lubricant thicknesses show that a larger depletion is observed for the thicker lubricant of each type at a given TFC heater power. Lubricants with lower bonded fraction show shorter recovery time after the slider is unloaded. From the current experiments it is extrapolated that Z-dol+A20H (30% bonded) lubricant recovers in a time scale of a few hours, while Z-tetraol+A20H (60% bonded) lubricant of comparable thickness takes a few days, and ZTMD (75% bonded) takes weeks to fully recover.

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