Less wear, longer life for memory storage device

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Probe storage devices read and write data by making nanoscale marks on a surface through physical contact. The technology may one day extend the data density limits of conventional magnetic and optical storage, but current probes have limited lifespans due to mechanical wear.

A research team, led by Intel Corp., has now developed a long-lasting ultrahigh-density probe storage device by coating the tips of the probes with a thin metal film. The team's device features an array of 5,000 ultrasharp probes that is integrated with on-chip electronic circuits. The probes write tiny bits of memory as small as a few nanometers by sending short electrical pulses to a ferroelectric film, a material that can be given a permanent electric polarization by applying an electric field.

High-speed data access requires that the probes slide quickly and frequently across the film. To prevent tip wear, which can seriously degrade the write-read resolution of the device, the researchers deposited a thin metal film of hafnium diboride (HfB_2) on the probe tips.

As the researchers describe in the American Institute of Physics' journal Applied Physics Letters, the metal film reduces wear and enables the probe tips to retain their write-read resolution at high speeds for distances exceeding 8 kilometers – greatly increasing the device's lifetime. The data densities of the device exceed 1 Terabit per square inch.

The work is an important step toward the commercialization of a probe-based storage technology with capacities that exceed those of hard disk and solid-state drives.