

Materials challenges for next generation high-density magnetic recording - media and readers

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The hard disk drive industry is making continuous efforts to increase the areal density of magnetic recording. To realize an areal density of higher than 2 Tbit/in² in the future, both media and readers need technical breakthroughs. Since the bit size will be in the range of 20 nm, the magnetic grains in the recording media must be reduced to less than 6 nm, requiring the use of ferromagnetic materials with high magnetocrystalline anisotropy such as L1₀ FePt. The shield-to-shield spacing of read sensors must also be smaller than 20 nm with low device resistance (resistance-area product RA~0.1 Ωμm²), which is very difficult to achieve using MgO based tunneling magnetoresistance devices. In this talk, we will address the materials challenges to the realization of an ideal media nanostructure using L1₀ FePt for heat-assisted magnetic recording (HAMR) media and narrow readers for > 2 Tbit/in² areal density. Recently significant progress has been made in current-perpendicular-to-plane giant magnetoresistive (CPP-GMR) devices using highly spin-polarized Heusler alloy ferromagnetic layers and new spacer materials. The very high magnetoresistance ratios achieved in CPP-GMR are encouraging for future read head applications of CPP-GMR, or its laterally extended version, lateral spin valves. The devices with high magnetoresistive output at low RA may open new applications in addition to disk read heads.



Kazuhiro Hono received the BS and MS degrees in Materials Science from Tohoku University in 1982 and 1984, respectively, and a Ph.D. degree in Metals Science and Engineering from Penn State in 1988. After working as a post doc at Carnegie Mellon, he became a research associate at the Institute for Materials Research, Tohoku University in 1990. He moved to the National Research Institute for Metals (currently National Institute for Materials Science, NIMS) as a senior researcher in 1995, and is now a NIMS Fellow and the Director of the Magnetic Materials Unit. He is also a professor in Materials Science and Engineering at the Graduate School of Pure and Applied

Sciences, University of Tsukuba. His current research interest is materials science in magnetic and spintronics materials and their devices. He is also active in the development of high performance permanent magnets without critical elements.

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