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The Influence of O_2 Gas on the Etch Characteristics of FePt Thin Films in $CH_4/O_2/Ar$ gas

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It is well known that magnetic random access memory (MRAM) is nonvolatile memory devices using ferromagnetic materials. MRAM has the merits such as fast access time, unlimited read/write endurance and nonvolatility. Although DRAM has many advantages containing high storage density, fast access time and low power consumption, it becomes volatile when the power is turned off. Owing to the attractive advantages of MRAM, MRAM is being spotlighted as an alternative device in the future. MRAM consists of magnetic tunnel junction (MTJ) stack and complementary metal-oxide semiconductor (CMOS). MTJ stacks are composed of various magnetic materials. FePt thin films are used as a pinned layer of MTJ stack. Up to date, an inductively coupled plasma reactive ion etching (ICPRIE) method of MTJ stacks showed better results in terms of etch rate and etch profile than any other methods such as ion milling, chemical assisted ion etching (CAIE), reactive ion etching (RIE). In order to improve etch profiles without redepositon, a better etching process of MTJ stack needs to be developed by using different etch gases and etch parameters. In this research, influences of O_2 gas on the etching characteristics of FePt thin films were investigated. FePt thin films were etched using ICPRIE in $CH_4/O_2/Ar$ gas mix. The etch rate and the etch selectivity were investigated in various O_2 concentrations. The etch profiles were studied in varying etch parameters such as coil rf power, dc-bias voltage, and gas pressure. TiN was employed as a hard mask. For observation etch profiles, field emission scanning electron microscopy (FESEM) was used.

Keywords: Inductively Coupled Plasma Reactive Ion Etching, FePt Thin Film, Magnetic Tunnel Junction, $CH_4/O_2/Ar$ gas