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Magnetic Thin Films for Perpendicular Recording

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Magnetic recording technology has shown a rapid growth over the past decade or more with the areal density growth rate more than 40% due to introduction of giant magneto-resistive (GMR), tunneling magneto-resistive (TMR) head and perpendicular recording technology. Current products are in the range of 300- 400Gb/in^2 and demonstrations of 600-800Gb/in^2 have occurred for perpendicular recording. Recent progresses are mainly due to improvement of magnetic thin film media signal to noise ratio. In this talk, we give a brief summary of recent progresses on perpendicular recording media technology and look at possible extension for ultra high areal density recording based on recording physics and media designs. First we are going to give a brief review on the advantages of the 1st generation of perpendicular recording media as compared to longitudinal recording media. Then the effect of media switching field and switching field distribution will be discussed. We show several different media designs and show its impact to the recording technology, including media with tilted anisotropy, media with coupled granular continuous (CGC) structure, media with exchange coupled composite structure and media with exchange spring system. In addition, we will discuss the impact of media grain size on achievable areal density, the ultimate limit for magnetic recording based on continuous media. Finally, a possible extension and its impact are discussed. As stated before, here we will not try to dig into very specific detail of each topic but look at the basic concept and physics behind each topic that may potentially lead to new technology break through.