



## Protection of brittle film against cracking

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### Abstract

This article reports on the protection of the brittle Zr-Si-O film against cracking in bending by the highly elastic top film (over-layer). In experiments the Zr-Si-O films with different elemental composition and structure were used. Both the brittle and highly elastic films were prepared by magnetron sputtering using a dual magnetron. The brittle film easily cracks in bending. On the other hand, the highly elastic film exhibits enhanced resistance to cracking in bending. Main characteristic parameters of both the brittle and highly elastic films are given. Special attention is devoted to the effect of the structure (crystalline, amorphous) of both the brittle and highly elastic top film on the resistance of cracking of the brittle film. It was found that (1) both the X-ray amorphous and crystalline brittle films easily crack in bending, (2) the highly elastic film can have either X-ray amorphous or crystalline structure and (3) both the X-ray amorphous and crystalline, highly elastic top films perfectly protect the brittle films against cracking in bending. The structure, mechanical properties and optical transparency of the brittle and highly elastic sputtered Zr-Si-O films are described in detail. At the end of this article, the principle of the low-temperature formation of the highly elastic films is also explained.

**Keywords:** Zr-Si-O film, Mechanical properties, Transparency, Film cracking, Protective film, Magnetron sputtering

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