

Fabrication of Cr_2AlB_2 and Cr_4AlB_4 MAB phase coatings by magnetron sputtering and post-annealing

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Cr_2AlB_2 coatings were prepared by combinatorial sputtering of tilt-fixed CrB and Al targets followed by ex-situ post-annealing. The deposition was carried out in a deposition system (ATS500, HHV Ltd, UK). The configuration of the targets and the substrates is shown in Figure S1. A CrB target (3' in diameter, 99.5% purity) and an Al target (3' in diameter, 99.999% purity) were symmetrically fixed at 20° with respect to the horizontal direction. The circular sample holder (7' in diameter) rotated horizontally at the speed of 30 rpm during sputtering to improve the homogeneity of the coatings. Three sites along the radius (Site (a) near the periphery, Site (c) near the center, and Site (b) in the middle) were chosen to place 1 cm×1 cm $\text{Al}_2\text{O}_3(0001)$ and Si(100) substrates. The base pressure in the deposition chamber was less than 2×10^{-4} Pa before introducing the sputtering gas (99.999% Ar). The CrB target was sputtered at 100 W using a DC magnetron. The Al target was sputtered at 100 W using a radio frequency magnetron. The sputtering pressure was 0.30 Pa. As-deposited coatings on $\text{Al}_2\text{O}_3(0001)$ were post-annealed in a tube furnace at 800°C for 7 h under Ar protection. GIXRD tests were carried out on the annealed samples. As-deposited coatings on Si(100) were used to measure the atomic ratio of Cr, Al, and B elements by ICP-OES (Table 2).

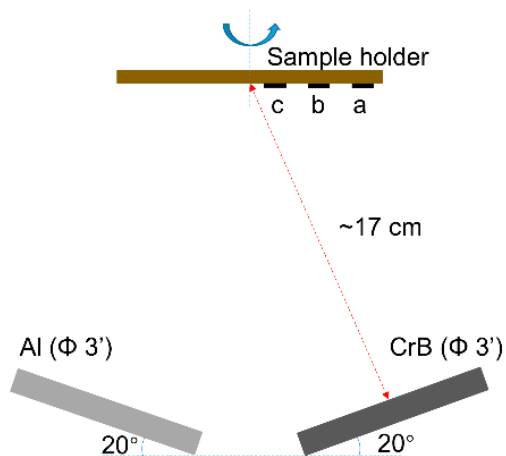


Figure S1. Combinatorial sputtering of CrB and Al targets.

Figure S2 shows the GIXRD patterns of the post-annealed coatings. Cr_2AlB_2 was detected as the dominant phase. Peaks at $41\text{--}43^\circ$ were attributed to Cr-Al binary impurity phases.

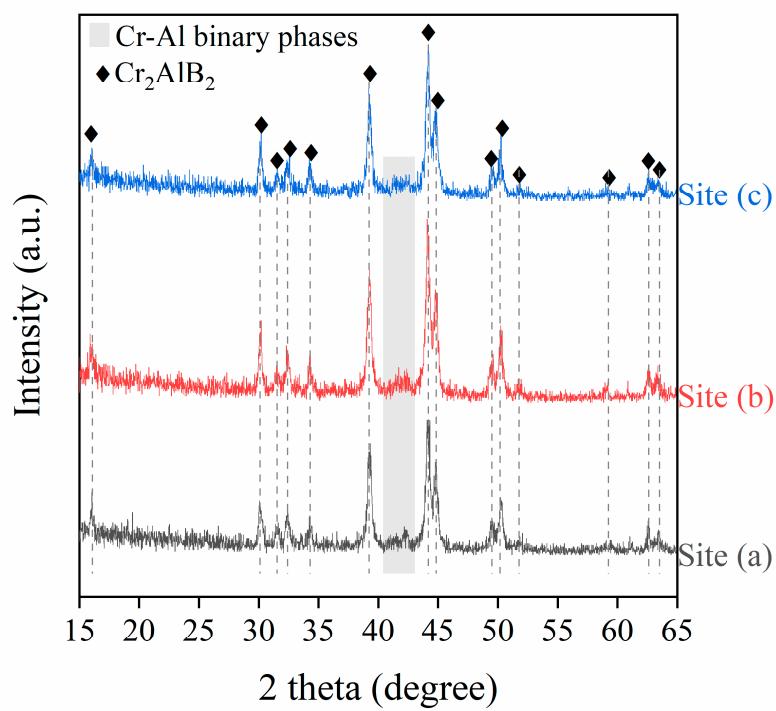


Figure S2. GIXRD patterns measured on the post-annealed coatings deposited at sites (a), (b), and (c).