FEASIBILITY RESEARCH OF GAINING “REFRACTORY HIGH ENTROPY CARBIDES” THROUGH IN SITU CARBURIZATION OF REFRACTORY HIGH ENTROPY ALLOYS

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High entropy alloys (HEAs) refer to solid solution alloys which contain five or more principal elements in equal or near equal atomic percent. Due to their unique structures, HEAs have superior comprehensive properties compared with the conventional alloys based on only one element. The property improvement based on the effect of high entropy may works on the refractory carbidies used in ultra-high temperature ceramics. Therefore, a solid carburization method was employed on a refractory high entropy alloy of HfZrTiTa to prepare in situ the possible “Refractory High Entropy Carbides”. The microstructure, micro-hardness and oxidation resistance of the carburized layer obtained at 900 °C for 10 h were investigated. It can be concluded that the carburized layer, ~120 μm thick in total, had a double layer structure. The Ti-depleted outer layer had an average hardness of ~1200 HV, while the inner layer, with evenly distributed and equimolar elements, had a maximum hardness of ~1590 HV. Although the final phase identification by TEM is under way, we believe that the carburized layer is composed of uniformly distributed carbides based on the results of hardness and element distribution. The substrate closely adjacent to the carburized layer had a higher hardness of ~725 HV compared with the HfZrTiTa alloy (~500 HV), due to the formation of Zr and Hf-rich Needle-like phases. The cyclic oxidation test showed that the carburization treatment on HfZrTiTa can improve its oxidation resistance to some extent.

Figure 1 the microstructure of the carbonized alloy and the result of micro-hardness test (A), EDS line scan result of the carbonized alloy (B), and the result of cyclic