

Solidification Microstructure of Al-Fe-V-Si Alloys

고 향 진, 박 우 진*, 김 낙 준
 포항공과대학교, * 산업과학기술연구소

The Solidification sequences in Al-Fe-V-Si alloys during strip casting and spray casting are described in terms of formation of the metastable phases. These processes offer relatively fast solidification rates and can produce near net shape products such as thin gauge strips or billets with the fine microstructure free from segregation. It has been shown that the microstructure of the alloys consists of various phases; bcc phase, microquasicrystalline phase, icosahedral phase, and the newly found phase. CBED analysis of the newly found phase revealed that the space group of the phase is P6/mmm, typical of hexagonal structure, and this was confirmed by Tanaka during "The Asian Seminar on New Direction on TEM and Nano-characterization of Materials". The lattice parameters of the phase has been found to be $a=2.514$ and $c=1.257$ nm of which c/a ratio is 0.5.

All the phases are structurally related, that is all the phases are constructed by several icosahedra, and also have close orientation relationship among them.

$$\begin{aligned} <i3>_{\text{icosa}} // [111]_{\text{bcc}}, (110000)_{\text{icosa}} // (352)_{\text{bcc}} \\ <i2>_{\text{icosa}} // [001]_{\text{bcc}}, (110000)_{\text{icosa}} // (100)_{\text{bcc}} \\ <i2>_{\text{icosa}} // [1120]_{\text{hexa}}, (110000)_{\text{icosa}} // (0001)_{\text{hexa}} \\ [0001]_{\text{hexa}} // [001]_{\text{bcc}}, (1120)_{\text{hexa}} // (100)_{\text{bcc}} \\ [1100]_{\text{hexa}} // [010]_{\text{bcc}}, (0001)_{\text{hexa}} // (001)_{\text{bcc}} \\ [1120]_{\text{hexa}} // [100]_{\text{bcc}}, (1100)_{\text{hexa}} // (010)_{\text{bcc}} \end{aligned}$$

The volume fraction and distribution of these phases depend on the solidification rate and the degree of undercooling. The degree of recalescence occurring during solidification also affects final microstructure, in that the less thermally stable phases transform to the stable phase. The decomposition behavior of the phases was investigated by means of in-situ hot-stage TEM.