TEM-Analysis of $Sm(Co,Fe,Cu,Zr)_z$ magnets for high temperature applications

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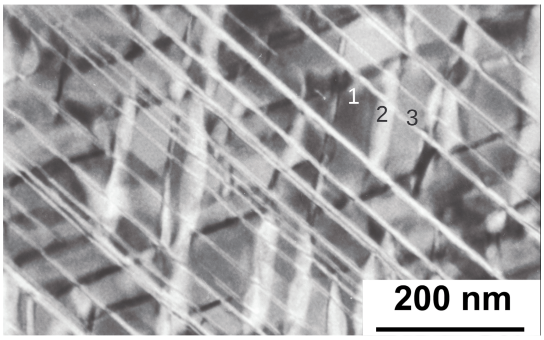
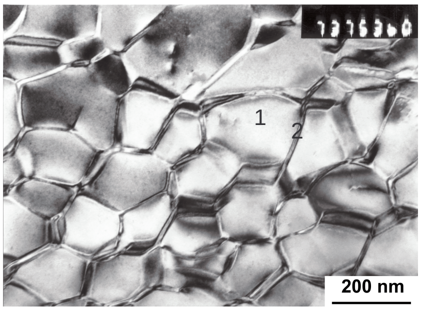
Advanced power applications require permanent magnets which are applicable at a working temperature up to 500°C. Because of the high magnetocrystalline anisotropy and the high Curie temperature $Sm(Co,Fe,Cu,Zr)_z$ magnets are the best candidate.

Microstructure



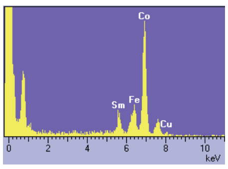
TEM image: viewing axis perpendicular to the c-axis

1 cell matrix phase:	$Sm_2(Co,Fe)_{17}$,	Th_2Zn_{17} type
2 cell boundary phase:	$Sm(Co,Cu)_5$,	$CaCu_5$ type
3 lamella phase:	$Sm_2(Co,Zr)_{17}$,	Th_2Ni_{17} type

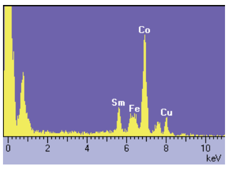


TEM image: viewing axis parallel to the c-axis

Microchemistry of cell matrix and cell boundary

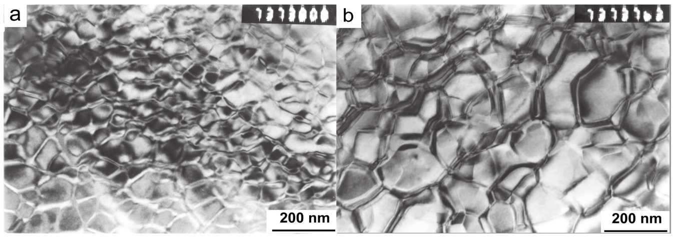


cell matrix:
enriched in Fe



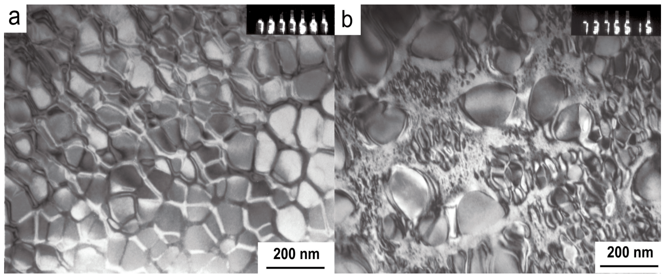
cell boundary:
enriched in Cu

Influence of the Sm content



TEM micrographs of $Sm(Co_{0,75}Fe_{0,14}Cu_{0,08}Zr_{0,04})_z$ with z=8,7 (a) and z=7,6 (b) showing the increasing cell size with decreasing Sm content.

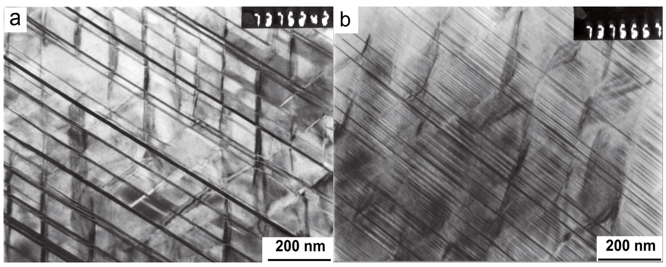
Influence of the Fe content



Microstructure of $Sm(Co_{0,77}Fe_{0,07}Cu_{0,13}Zr_{0,03})_z$
a) z = 7,6: cellular precipitation structure
b) z = 6,9: cluster of very small cells and some very large cells

Influence of the Cu content

Cu mainly seggragates in the cell boundary phase, but it has also an influence on the lamella density.



$Sm(Co_{bal}Fe_{0,14}Cu_xZr_{0,023})_8$ - A high Cu content favours the occurrence of microtwinning instead of the formation of platelets. a) 6,6 at.% Cu, b) 11 at.% Cu

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