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OBSERVATIONS BY TRANSMISSION ELECTRON MICROSCOPY OF THE ANTIPHASE BOUNDARIES IN A $D0_3$ ORDERED Fe_3Al ALLOY

[1]Couto, A.A. & Ferreira, P.I.
[1]Departamento de Engenharia de Materiais, Instituto de Pesquisas Energéticas e Nucleares, Comissão Nacional de Energia Nuclear (IPEN-CNEN/SP),
Caixa Postal: 11049, CEP:05422-970 – Pinheiros, São Paulo - Brasil

Fe_3Al alloy can be described as a family of alloys with aluminium content between 18.5 and 35 at.%, presenting ordering at low temperatures and disorder at high temperatures. These alloys present two types of ordered structures, B2 and $D0_3$. Ordering is a phenomenon, so that once atoms of a particular type join one sublattice they will continue to do so during the growth of that ordered region. Separately nucleated regions or domains may adopt a different sublattice occupancy but when two such domains impinge an antiphase boundary, APB, is created across which atoms on a particular sublattice change their allegiance. The vector connecting the corresponding sublattices across the boundary is termed the antiphase boundary vector. An antiphase boundary is visible in transmission electron micrographs because electron waves scattered by atoms belonging to a particular sublattice on one side of the boundary are not in phase with the waves scattered by the same sublattice on the other side of the boundary. The purpose of present work is observing the APB of $D0_3$ ordered Fe-30Al-0,15Zr-0,2B (at.%) alloy. Two types of antiphase vector, $a'_0/2<010>$ and $a'_0/4<111>$ (where a'_0 is the lattice parameter of $D0_3$ phase), occur in the $D0_3$ phase and that these can be distinguished by dark field microscopy. Both types of boundary are visible in dark field images formed with superlattice reflections of the type $h+k+l$ = odd integer, whereas only the $a'_0/4<111>$ boundaries are revealed by superlattice reflections of the type $(h+k+l)/2$ = odd integer. Figure 1 shows the dark field micrograph using (111) reflection, revealing the APB contrast of $a'_0/2<010>$ type of $D0_3$ ordered Fe-30Al-0,15Zr-0,2B (at.%) alloy. Figure 1 shows the dark field micrograph using (222) reflection, evidencing the APB contrast of $a'_0/4<111>$ type of the same alloy. In figure 2, it is possible observe too the APBs of $a'_0/2<010>$ type, smaller than the APBs of $a'_0/4<111>$ type. The possibility of simultaneous observation of the two types of APB is due to the choice of (222) reflection, parallel to the (111) reflection.

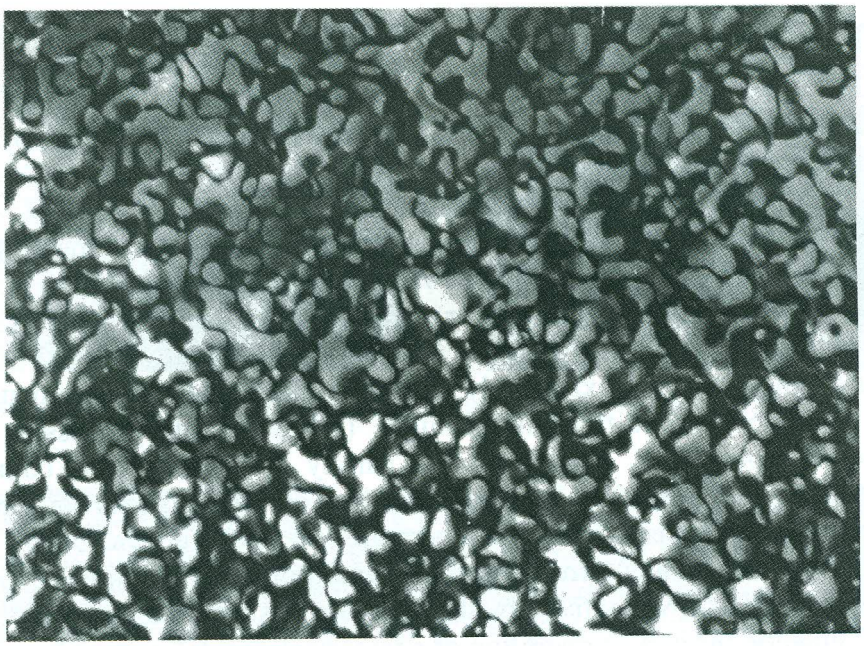

Figure 1: A (111) dark field micrograph in a $D0_3$ ordered Fe-30Al-0,15Zr-0,2B (at.%) alloy heat-treated at 500 °C / 1 h. (Aumento: 30.000X)

Figure 2: A (222) dark field micrograph in a $D0_3$ ordered Fe-30Al-0,15Zr-0,2B (at.%) alloy heat-treated at 500 °C / 1 h. (Aumento: 30.000X)