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Effect of Mo content on the Structural and Physical Properties of Cr_{100-<i>x </i>}Mo_{<i>x</i>}Alloys

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Abstract content
   (Max 300 words)
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Antiferromagnetic order in Cr is attributed to the formation of a spin density wave (SDW) when the electron and hole Fermi sheets overlap on cooling through the Néel temperature (<i>T</i>_N). This nesting effect is sensitive to changes in the electron-to-atom (<i>e/a</i>) ratio and is influenced by the diluent materials used with Cr. Alloying with elements to the left of Cr on the periodic table reduces the size of the electron sheet and results in lowering <i>T</i>_N with increasing diluent concentration, while elements to the right of Cr have an opposite effect. Considering this, investigations into the physical properties of Cr alloys with isoelectronic elements is important, as it rules out this effect of <i>e/a</i>. Alloying Cr with Mo, which is isoelectric with Cr, shows an unexpected decrease in <i>T</i>_N with increasing Mo concentration [1]. This is attributed to the delocalization of the 3-d bands in Cr through the introduction of the 4-d electrons of Mo [1]. In the present investigation the effect of Mo concentration on the structural, magnetic and electrical properties of Cr is systematically studied. A series of Cr_{100-<i>x</i>}Mo_{<i>x</i>} alloys, with <i>x</i> = 0, 3, 7, 15 and 25, was prepared and the actual concentrations established using electron microprobe analysis. XRD studies confirm the bcc structure of these alloys and indicate an increase in lattice constant with increase in Mo concentration. The crystallite sizes calculated from these results for the Cr_{100-<i>x</i>}Mo_{<i>x</i>} alloys ranges between 15 to 30 nm. The physical properties of these alloys were investigated through susceptibility (<i>χ</i>), Seebeck coefficient (<i>S</i>), resistivity (<i>ρ</i>) and Hall coefficient (<i>R</i>_{<i>H</i>}) as function of temperature (<i>T</i>) measurements. <i>T</i>_N-values obtained from these measurements are comparable. Interestingly, for sample <i>x</i> = 3, χ(<i>T</i>) shows a spin-flip transition at <i>T</i>_{SF} ≈ 65K and <i>R</i>_{<i>H</i>}(<i>T</i>) indicates a change in mobility carriers at <i>T</i> ≈ 100K.

[1] Fawcett E <i>et al</i>. 1994 <i>Rev. Mod. Phys </i>. 66 25.

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