- **Nanocomposites and nanomaterials**

# Synthesis and characterization of $(Cr_xV_{1-x})_{n+1}AlC_n$ solid solution

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MAX phases are a class of ternary nitrides and carbides, with the general formula $M_{n+1}AX_n$. These phases have a hexagonal crystal structure that consists of edge-sharing $[M_6X]$ octahedron interleaved with A layers; they are thus considered as nanolaminated-layered materials with a unique combination of metal and ceramic properties [1]. For example, they are resistant to oxidation and corrosion, elastically stiff, but at the same time, they also demonstrate high thermal and electrical conductivities and they are machinable.

$(Cr_xV_{1-x})_{n+1}AlC_n$ MAX phases solid solutions with n=1, 2, 3 and x=0, 0.25, 0.5, 0.75, 1 were obtained from commercial Cr, V, Al and C powders by using pressureless reactive sintering at high temperature (1400°C to 1600°C) or hot isostatic pressure technique (80MPa, 1450°c).

X-ray powder diffraction analysis confirmed the existence of continuous $(Cr_xV_{1-x})_2AlC$ solid solution, the amounts of additional phases increasing with the synthesis temperature and the V content. The synthesis of $(Cr_xV_{1-x})_3AlC_2$ and $(Cr_xV_{1-x})_4AlC_3$ phases was realized only for x=0.25; 0.5; 0.75 and x=0; 0.25; 0.5, respectively.

Structural parameters of all modifications of $(Cr_xV_{1-x})_{n+1}AlC_n$ solid solution were established by full profile Rietveld refinements. Lattice parameters and cell volumes decrease linearly with increasing the Cr content, while the values of z positions (free parameters in the unit cell) remain almost constant. The evolutions of the interatomic and interlayer distances as a function of x and n have been constructed.

1. *Barsoum M. W.* The $M_{n+1}AX_n$ phases: A new class of solids thermodynamically stable nanolaminates // Progress in Solid State Chemistry.-2000.- **28**.-P. 201-281.