

// PRODUCTION OF MAX PHASES BY MOLTEN SALT SHIELDED SYNTHESIS

Ref-No: TA-S0084

BACKGROUND

MS3 is based on the encapsulation of the precursor materials in a salt media (KBr), followed by a heat treatment in air to synthesize powders. As the process is carried out using a salt media, just a simple washing in water leads to obtain the powders without any milling step. These two factors (processing in air and no milling) are a huge breakthrough in comparison to industrial processes to synthesize non-oxide powders, where protective atmospheres (vacuum or argon) and milling steps are required.

MS3 process has been successfully used to synthesize Ti_3SiC_2 , Ti_2AlC , Cr_2AlC and Ti_2AlN up to 500g/batch. The next step is to scale-up the process to be able to synthesize at least 4kg/batch of highly pure powders.

PROBLEM

MAX phases are a new family of materials with high potential for high temperature applications due to their unique combination of properties, bridging the gap between ceramics and metals. However, application of MAX phases has been limited due to the difficulties to synthesize large quantities of highly pure powders at a reasonable costs. Up to now, synthesis of large batches of MAX phases implies the formation of secondary phases, which have a detrimental effect on the final response of the materials at high temperature. Furthermore, conventional processes to synthesize MAX phases are less attractive for industry due to the high costs associated with the protective atmospheres and milling steps.

SOLUTION

This problem can be solved using MS3 process to produce MAX phase powders, since the purity is high and large batches can be produced. MS3 is simple, cheap, and environmentally-friendly, so it will be attractive to industry. We will mainly focus on the synthesis of MAX phase powders, but we will also investigate the synthesis of other non-oxide materials due to the high interest from different companies.



Forschungszentrum Jülich GmbH

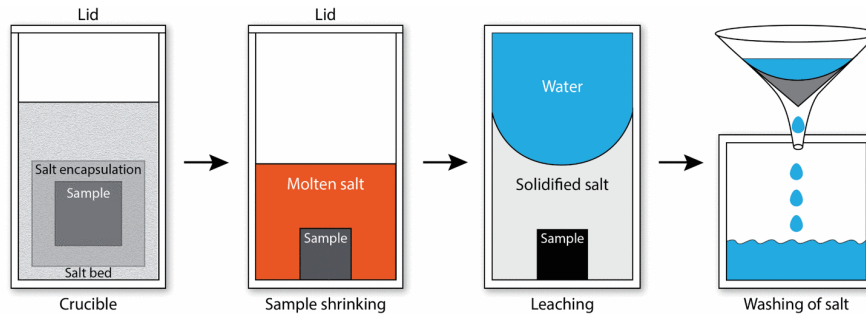
Dr. Ute Schelhaas
+49 2461/61-9007
u.schelhaas@fz-juelich.de
www.fz-juelich.de

DEVELOPMENT STATUS

Demonstration model

CATEGORIES

//Energy
engineering //Chemistry //Chemical
synthesis and process
engineering //Materials science and
engineering //Smart
materials //Surface
engineering
//Engineering //Aeronautics and
astronautics //Process
engineering //New-found chemical
substances



SCOPE OF APPLICATION

- MS3 will be used to synthesize MAX phases, in particular Ti_3AlC_2 , Ti_2AlC , Cr_2AlC , V_2AlC , Nb_4AlC_3 , $MoAlB$, and Ti_3SiC_2 as well as other phases depending on the demand. The main application of these phases are for high temperature, such as structural components for gas turbines, coatings, Concentrated Solar Power (CSP), porous catalytic supports and targets for PVD.
- MS3 will be also employed to synthesize other non-oxide powders such as SiC and alloys.

SERVICE

If you have questions about the technology please refer to:

Prof. Dr. Jesus Gonzalez-Julian
 Forschungszentrum Jülich GmbH
 Institute of Energy and Climate Research (IEK-1)
 Phone: +49 (0) 246161 96761
 Email: j.gonzalez@fz-juelich.de

Dr. Apurv Dash
 Forschungszentrum Jülich GmbH
 Institute of Energy and Climate Research (IEK-1)
 Phone: +49 (0) 2461 61-9878
 Email: a.dash@fz-juelich.de