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ABSTRACTS

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- sintering) in inert gas media and sealed containers. Such processing complicates industrial application. As alternate way for fabrication of the matrices for Tc-99 isolation technology via SHS (self-sustaining high-temperature synthesis) is suggested. The formation of the phases during SHS proceeds for a very short time, decreasing the loss of elements due to evaporation. Other ways to reduce release of Tc are achieved by introduction of Tc into initial batch not as Tc2O7 but in sorbed form with TiO2 or as TcO2 with a higher melting point and lower tendency for vaporization.

CB-11.5:IL05 **Development of Science Intensive Production Based on Important Scientific Discoveries**
A.G. Merzhanov, ISMAN, Chernogolovka, Moscow region, Russia

The idea of practical realization of the scientific discovery of solid flame combustion is discussed. It is well known that the important discoveries (such as laser emission, low-temperature plasma, etc.) find their practical application in everyday life and become essential in engineering, industry and economy. Any production based on the scientific investigation is called science intensive production. Their proper organization and application require a very deep knowledge of the scientific or technological backgrounds as well as thorough analysis of the market and technological conditions. The author regards the organization of large-scale centers (scientific facilities) as a strategic solution of the problem. In these centers besides the investigation of new technologies, equipment, materials, and their application in different areas, such important steps as practical approbation of the obtained achievements, staff training, and market analysis would be studied. Organization of such centers is considered for realization of the phenomenon of solid flame which appeared to be a scientific background of the promising method of Self-propagating High-temperature Synthesis.

CB-11.5:IL06 **Past and Current Accomplishments in Production of Ceramic Powders and Structures by Self-Propagating High-Temperature Synthesis Method**
Jan A. Puszynski[1]*, Alan Degraw[2], [1]South Dakota School of Mines and Technology, Rapid City, SD, USA; [2]Advanced Material Technologies, Inc., Morristown, TN, USA

A comprehensive review of both past and current world-wide accomplishments in the area of combustion synthesis, with special emphasis on the production of oxide and nonoxide ceramic powders, will be presented. This review will focus on scale-up and production initiatives undertaken by international companies and institutions. A significant part of this presentation will be dedicated to manufacturing of dense and porous structures involving combination of self-propagating high-temperature technique with other processing methods. Finally, new initiatives and challenges associated with this novel synthesis technique will be discussed.

CB-11.5:L07 **Porous SHS - Ceramics**
Yu.M. Maksimov[1]*, A.I. Kirdyashkin[1], V.K. Baev[2], A.N. Guschin[1], [1]Department for Structural Macrokinetics of Tomsk Scientific Centre SB RAS, Tomsk, Russia; [2]Khristianovich Institute of Theoretical and Applied Mechanics, Novosibirsk, Russia

Based on complex investigations, interrelation between the structure formation of porous ceramics and thermal conditions of SHS wave was revealed. Experimental - industrial works testing various functionality of produced porous products have been carried out. Metalloceramic filters such as Al_2O_3, SiO_2, Ti, Si, C to filtrate liquid and gases were obtained by SHS. Based on intermetallic systems, functional burners converting energy from gas burning into radiant heat energy have been developed. At present, the radiant burners with a capacity of 2000 kW are used in gas boiler rooms and allow saving up to 10% of gas. Porous SHS products from metal oxide composites have shown high affectivity by using them as block catalysts to convert chemical natural gas into synthesis - gas with a conversion level of 95%.

Poster Presentation

CB-11:P02 **Utilization of NbC Nanoparticles Obtained by Reactive Milling in the Production of Alumina Niobium Carbide Nanocomposites**
V. Trombini *, A.H.A. Bressiani, Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP, Brazil; E.M.J.A. Pallone, USP, Faculdade de Zootecnia e Engenharia de Alimentos, Pirassununga, SP, Brasil; R. Tomasi, UFSCAR- DEMa Sao Carlos, SP, Brazil

The great interest for nanostructured materials is due to the improvements on the mechanical properties of final products. The same ones present a significant increase on the properties as hardness, wear and, in some cases, strength and toughness, when compared to monolithic ceramic. These improvements attracted attention of ceramic cutting industry, because better cutting tools can lead to an increase in production. In this work reactive high-energy milling, which can lead to self-sustaining reactions (SHS), was used for synthesis of NbC nanoparticles. The reaction products were desagglomerated and mixed with commercial ultra-fine alumina powder, producing alumina matrix nanocomposites with 5vol% of nanometric NbC. These nanocomposites was characterized physical, microstructural and mechanically. Results shown that is possible to obtain nanocomposites, with high densities and high values of hardness, from the powders obtained by reactive milling.

Focused Session CB-12

LAYERED AND FUNCTIONALLY GRADED MATERIALS

Oral Presentations

Session CB-12.1
Layered and Graded Materials, Composites and Hybrids

CB-12.1:IL01 **The Potential of Spark Plasma Sintering (SPS) Method for the Fabrication on an Industrial Scale of Functionally Graded Materials (FGMs)**
M. Tokita, NJS Co., Ltd., Yokohama, Japan

The Spark Plasma Sintering (SPS) Method is a solid compressive and pulsed electric current energizing sintering technique, that has lately drawn considerable attention as one of the newest rapid sintering method with excellent energy density control and capable of producing homogeneous Functionally Graded Materials (FGMs), nano-structural sintered compacts, thermoelectric materials and Bio-materials, in short time. Today in Japan, a number of SPSed products for different industries have already been realized. Although the SPS technology still involves an unclear fundamental mechanism portion, the cost reduction technology are currently making progress. Therefore, the SPS is now moving from academia and/or R&D proto-type product level to practical industry use product stage especially in the field of mold & die industry, cutting tools industry, electronics industry and automobile industry so on. A commercial scale production process utilizing SPS Method has been developed by applying an Advanced SPS machine systems, processing techniques and powder technology based on the triunity system concept. For the industrialization practically, it is essential to study on the technology integration. This is of great interest to the powder and powder metallurgy industry for both the new product developments and manufacturing applications. The ability of the advanced SPS process to apply a wide variety of materials in applications varying from structural materials to functional materials provides a versatility, high productivity and reproducibility with enormous potentiality for cost effectiveness and widespread use in a practical industrial product.