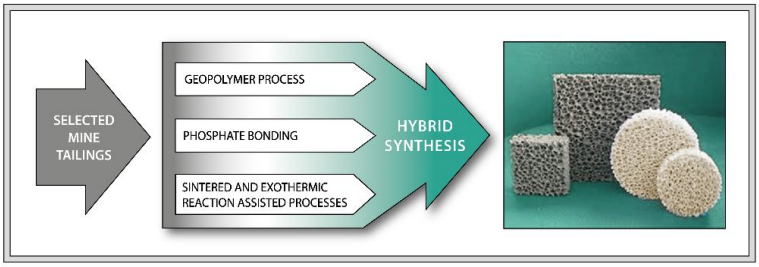
CeraTAIL NOVEL SYNTHESIS METHODS FOR POROUS CERAMICS FROM MINE TAILINGS

Porous ceramics have become essential in a wide array of industrial processes, due to the inherent inertness and high strength of ceramics in harsh conditions – they are frequently used as filters, catalyst supports, insulators and absorbents. The production volume of these is in the millions of tons a year. Today's technical ceramics often rely on the purest raw materials, which has led to unsustainable situations. As is the case with MgO: even though magnesium is abundant everywhere on Earth European refractory manufacturers are forced to use Chinese imported magnesite due to its purity, making MgO a critical raw material. Therefore it is essential to develop ceramic processing routes that are less sensitive to raw material purity. This has become attainable due to emergence of chemical ceramic processing routes, and deeper understanding on reactions.



The long term objectives of this proposal are:

i) Enable the use of mine tailings as a major raw material to address the future need for porous ceramics in large quantities to alleviate the environmental burden *(societal and environmental objective)*

ii) To identify and study the most potential mine tailings and low energy processing routes for inert porous ceramics *(scientific and environmental objective)*

iii) To identify the effect of raw material variations on ceramic structure, properties and porosity by understanding the mechanisms of action. *(scientific objective)*

The main hypothesis of this proposal:

By screening mine tailings and characterizing active, passive and deleterious components for each processing route and process combinations, it is possible to select most potential raw materials to achieve structurally sound porous ceramics.

The project will be carried out in close co-operation between the consortium partners UO (geopolymer processing), TUT (phosphate bonding), VTT (exothermic sintering) and GTK (geology and mineralogy). The collaboration of this scale between UO, TUT, VTT and GTK is unique. Combination of the different processes to work simultaneously will give new insight which would not be possible without this unique consortium. The consortium combines expertise in applied physics, materials processing, materials science, geosciences, ceramics, mineralogy, geochemistry, physical chemistry and environmental technology.

These new processing techniques are expected to enable high porosity ceramic materials from low quality raw materials, and they will be studied in this project to obtain porous ceramics from mine tailings.

Researchers working in your group + their titles or tasks

Fiber and Particle Engineering group, University of Oulu (UO)
-Jouko Niinimäki, Dr. (Tech), Professor, consortium PI
-Mirja Illikainen, Dr. (Tech.), professor
-Paivo Kinnunen, Dr., post-doctoral researcher
-Harisankar Sreenivasan, MSc, doctoral researcher

Material and manufacturing, VTT Technical Research Centre of Finland Ltd (VTT)
-Päivi Kivikytö-Reponen, Dr. (Tech.), Senior Scientist, subproject PI
-Juha Lagerbom, Lic. Tech., Research Scientist
-Marjaana Karhu, M.Sc. (Tech), Doctoral Researcher

Ceramic Materials group, Department of Materials Science, Tampere University of Technology (TUT)
-Erkki Levänen, Dr. (Tech.) professor, subproject PI
-Arnold Ismailov, M.Sc. doctoral student

Geological Survey of Finland (GTK)
-Marja-Liisa Räisänen, PhD, Senior Scientist
-Soili Solismaa, M.Sc., Geologist

Contact information

Prof. Mirja Illikainen, Dr. (Tech.),
Fibre and particle engineering lab
Faculty of Technology
University of Oulu
PL 4300
FI-90014 University of Oulu
Finland
+358 (0) 40 588 5904
mirja.illikainen@oulu.fi

Päivö Kinnunen, Dr.
Fibre and particle engineering lab
Faculty of Technology
University of Oulu
PL 4300
FI-90014 University of Oulu
Finland
+358 (0) 29 448 8020
paivo.kinnunen@oulu.fi

Päivi Kivikytö-Reponen, Dr. (Tech.)
Materials and manufacturing
VTT Technical Research Centre of Finland Ltd
P.O. Box 1300
FI-33101 Tampere
Finland
+358 40 483 5785
paivi.kivikyto-reponen@vtt.fi

Juha Lagerbom, Lic. Tech.,
Materials and manufacturing
VTT Technical Research Centre of Finland Ltd
P.O. Box 1300
FI-33101 Tampere
Finland
+358 40 355 8024
juha.lagerbom@vtt.fi

Marjaana Karhu, M.Sc. (Eng.)
Materials and manufacturing
VTT Technical Research Centre of Finland Ltd
P.O. Box 1300
FI-33101 Tampere
Finland
+358 40 536 5926
marjaana.karhu@vtt.fi

Prof. Erkki Levänen, Dr. (Tech.)
Ceramic Materials group
Department of Materials Science
Tampere University of Technology
P.O. Box 599
FI-33101 Tampere
Finland
+358 40 849 0191
erkki.levanen@tut.fi

Arnold Ismailov, M.Sc. doctoral student
Ceramic Materials group
Department of Materials Science
Tampere University of Technology
P.O. Box 599
FI-33101 Tampere
Finland
+358 40 849 0581
arnold.ismailov@tut.fi

Marja-Liisa Räisänen, PhD.
Industrial Environments and Recycling
Geological Survey of Finland
P.O. Box 1237
FI-70211 Kuopio
Finland
+358 40 534 461
marja-liisa.raisanen@gtk.fi

Soili Solismaa, M.Sc.
Industrial Environments and Recycling
Geological Survey of Finland
P.O. Box 1237
FI-70211 Kuopio
Finland
+358 50 349 3087
soili.solismaa@gtk.fi

ACADEMY OF FINLAND

TAMPERE UNIVERSITY OF TECHNOLOGY

GTK

OULUN YLIOPISTO
UNIVERSITY of OULU

VTT