“Functional Materials for Energy”

Online Seminar, 1-2 JUN 2021

2 days, 16 speakers from many highly qualified sources, wide spectrum of topics:

- hard magnets
- magnetocaloric materials
- thermoelectric materials
- materials for thermal management
- energy storage materials
- hydrogen production
- high temperature material
- recycling, use of resources

- Networking tool available

Abstracts Brochure

EPMA european powder metallurgy association

Fraunhofer IFAM · LNEG · uc3m · ceit · POLITECNICO MILANO 1863 · Hochschule Aalen · Universidad de Navarra · femto-st SCIENCES & TECHNOLOGIES · UNIVERSITÉ DE FRANCHE-COMTÉ · SANDVIK · UGA Université Grenoble Alpes · imem · PITT SWANSON ENGINEERING MECHANICAL & MATERIALS SCIENCE · liten cea tech · AM3 Advanced Manufacturing & Magnetic Materials Lab · SUSMAGPRO SUSTAINABLE RECOVERY, REPROCESSING AND REUSE OF RARE-EARTH MAGNETS IN THE CIRCULAR ECONOMY · HS PF




Register at seminars.epma.com, deadline 26 May

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PROGRAMME:

FM SEMINAR : 1- 2 June 2021				
1st June 2021				
9:30	10:00	*Premeeting and participants admission*		0:30
10:00	10:20	CEIT presentation	Dr Jose Manuel Martin - CEIT-BRTA	0:20
10:20	10:40	EPMA presentation	Dr Bruno Vicenzi (EPMA)	0:20
10:40	11:00	Self-presentation of participants	All	0:20
11:00	11:15	*Coffee break / Chat room available*		0:15
11:15	11:45	Recent developments in the manufacturing of NdFeB magnets for energy applications	Dr Jose Manuel Martin - CEIT-BRTA	0:30
11:45	12:15	Net-shape NdFeB magnets made by Powder Injection Moulding (PIM): lowering the organic contaminations	Mr Thomas Bioud - Univ. Grenoble Alpes & CEA-LITEN, DTNM	0:30
12:15	13:45	*Lunch break / Chat room available*		1:30
13:45	14:15	Hydrogen Assisted Recycling of Critical Rare Earth Elements for the Energy Sector	Prof Dr Carlo Burkhardt - Hochschule Pforzheim &	0:30
14:15	14:45	Recycling of FeNdB permanent magnets	Prof Dr Dagmar Goll - Aalen University, Materials Research Institute	0:30
14:45	15:15	Processing large, complex soft-magnetic components of amorphous iron-based powder alloys by selective laser melting	Dipl-Ing Lena Thorsson - Exmet AB	0:30
15:15	15:30	*Coffee break / Chat room available*		0:15
15:30	16:00	Comparison of Binder Jet 3D Printing and Direct Energy Deposition of Ni-Mn-based Functional Magnetic Materials	Prof Dr Markus Chmielus - University of Pittsburgh	0:30
16:00	16:30	Functional materials elaborated with magnetocaloric powders or nanosized particles dispersion-strengthened tungsten for innovative energy applications	Prof Thierry Barriere - Université de France-Comté	0:30
16:30	17:00	Scale-up of magnetocaloric NiCoMnIn Heuslers by powder metallurgy for room temperature magnetic refrigeration	Dr Simone Fabbrici - IMEM - CNR Parma	0:30
17:00	17:15	*Further discussion - End of the day / Chat room available*		0:15
2nd June 2021				
10:00	10:30	*Premeeting and participants admission*		0:30
10:30	10:50	Self-presentation of participants	All	0:20
10:50	11:20	Using waste from the Barrigão abandoned mine as source of raw material for the synthesis of tetrahedrite-tennantite materials for a sustainable future	Dr Filipe Neves - Laboratório Nacional de Energia e Geologia – LNEG, I.P.	0:30
11:20	11:50	MAX phase materials for High Temperature Heat Exchangers: challenges and opportunities	Dr Sophia Tsipas - Universidad Carlos III de Madrid	0:30
11:50	13:30	*Lunch break / Chat room available*		1:40
13:30	14:00	Hybrid and metallic phase change materials for thermal storage and management	Prof Elisabetta Gariboldi - Politecnico di Milano	0:30
14:00	14:30	Sintered open porous copper-zeolite composites	Dr Jörg Weise - Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM	0:30
14:30	15:00	Sintered electrodes for alkaline water electrolysis	Dipl-Ing Thomas Rauscher - Fraunhofer IFAM Dresden	0:30
15:00	15:15	*Coffee break / Chat room available*		0:15
15:15	15:45	Materials and Processes for Next Generation Batteries	Dr Ing Frederieke Langer - Fraunhofer Institute for Manufacturing Technology and Advanced Materials IF	0:30
15:45	16:15	Performance of Sandvik Osprey Ni-base superalloys produced via laser powder bed fusion for high temperature applications	Dr Leandro Feitosa - Sandvik	0:30
16:15	16:45	Oxidation resistant tungsten-based alloys for high temperature applications	Prof Carmen García-Rosales - CEIT & TECNUN-Universidad de Navarra	0:30
16:45	17:00	*Further discussion - End of the seminar / Chat room available*		0:15

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"Functional Materials for Energy"

1-2 JUN 2021

Online Seminar

SPEAKER

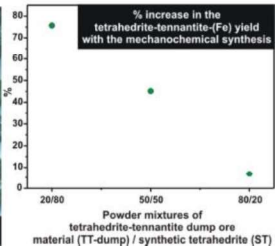
2 Jun, 10:50-11:20

Dr Filipe Neves
Researcher
LNEG, I.P.

"Using waste from the Barrigão abandoned mine as source of raw material for the synthesis of tetrahedrite-tennantite materials for a sustainable future"

Abstract/1

Introduction: The green transition implies the use of a broad mixture of renewable energy sources where materials science-based solutions are vital for designing improved materials and devices. Despite the progress that has been achieved in the development of materials for sustainable energy technologies, current research is still facing many challenges (e.g., materials availability and processability to achieve low cost, efficiency, durability and environmental concerns). Furthermore, as part of the sustainable development agenda, the European Union's Raw Materials Initiative sets out a strategy based on three pillars, one of which deals with resource efficiency and supply of "secondary raw materials" through recycling. Among the many possible materials research areas for energy applications, thermoelectric materials are a very active research topic. Natural and synthetic tetrahedrite-tennantites have been highlighted as promising materials for the development of clean and sustainable energy technologies based on thermoelectricity. However, the direct use of natural tetrahedrite-tennantite minerals as thermoelectric materials has been limited by their low thermoelectric performance as a result of the high electric resistivity. Recent studies have shown that mixing ore with a fraction of synthetic tetrahedrite have led to the synthesis of tetrahedrite-tennantite materials with enhanced thermoelectric performances .One of the sulfosalt minerals present in the waste dumps of the abandoned Barrigão copper mine, located in the Portuguese zone of the Iberian Pyrite Belt, include the tetrahedrite-tennantite fahlore-group (Cu12-x(TM)x(Sb,As)4S13, TM – transition metal). Knowing that the chemical composition of the mineral varies with location where it is mined, it is always important to evaluate the use of minerals from different geographical origins. Taking the above into consideration and the potential economic and environmental benefits, the present study intents to demonstrate the feasibility of the direct incorporation of tetrahedrite-tennantite dump material as raw material in the processing cycle of tetrahedrite-tennantite materials through mechanochemical synthesis.



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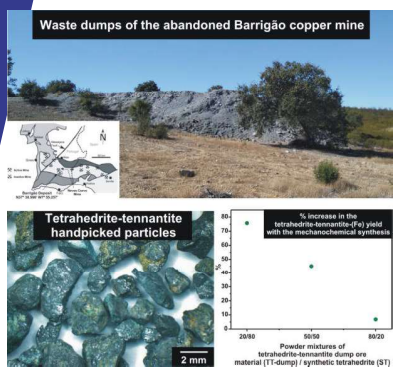

Abstract/2

Experimental: Ore-bearing hand specimen size samples collected in the Barrigão mine dumps were crushed and pulverized. Subsequently, tetrahedrite-based materials were prepared by mechanochemical synthesis, performed in a planetary ball mill for 2h, from powder mixtures containing different mass ratios (ranging from 20% to 80%) of tetrahedrite-tennantite dump material and synthetic tetrahedrite (also prepared by mechanochemical synthesis from mixtures of elemental powders). Uniaxially pressed pellets from the mechanochemical synthesized powders were heat-treated in vacuum at temperatures between 350 ºC – 450 ºC. Phase formation and chemical homogeneity were investigated using X-ray diffraction and transmission and scanning electron microscopy.

Results: From the structural and microstructural characterization of the starting and processed materials, the following was observed: (a) Barrigão ore samples consisted of an iron-rich tetrahedrite-tennantite coexisting with chalcopyrite and quartz; (b) tetrahedrite (main phase), famatinite and skinnerite were present in the synthetic tetrahedrite samples; (c) with the mechanochemical synthesis, there was a complete dissolution of the Barrigão ore sulfides with the constituents of the synthetic tetrahedrite giving rise to the formation of a solid solution that, generically, could be considered as a tetrahedrite-tennantite phase with iron. Famatinite phase was observed in the mixtures with an initial ore ratio of 20%, while quartz was present in all processed materials; (d) independently of the initial ore ratio, an increase in the amount of the tetrahedrite-tennantite phase was obtained with the mechanochemical synthesis when compared with the amount already present in the starting materials; (e) no phase decomposition was observed in the heat-treated pellets meaning that the tetrahedrite-tennantite phase formed during the mechanochemical synthesis is stable for temperatures up to 450 ºC.

Conclusions: The results obtained demonstrates the feasibility for the direct use, without any pretreatment steps, of tetrahedrite-tennantite dump material, collected in the Portuguese zone of the Iberian Pyrite Belt, in the processing cycle of tetrahedrite-tennantite materials through mechanochemical synthesis. The conclusions of this study are of major relevance in light of their potential use as thermoelectric materials.

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