

# A NOVEL ULTRA-LIGHTWEIGHT SUPERCONDUCTOR WIRE



## CUTTING EDGE TECHNOLOGY

- Novel ultra-lightweight superconductive wire based on magnesium diboride ( $MgB_2$ ) core stabilized with unique aluminum (Al) composite sheath.
- The Al composite material, named HITEMAL<sup>®</sup>, consists of ultrafine-grained Al stabilized and strengthened with nanoscale alumina ( $Al_2O_3$ ) particles and meets all demanding and contradictory requirements placed on the sheath material of  $MgB_2$  core superconductor wire.
- **HITEMAL<sup>®</sup> - High TEMperature ALuminum**
  - technologically allows the fabrication of ultra-lightweight superconducting wire based on  $MgB_2$  core through the process known as internal magnesium (Mg) diffusion (IMD) into boron (B),
  - mechanically stabilizes the Mg + B powder core during cold working operations and it's stable at the temperature of Mg melting,
  - sheath provides advantageous mechanical and electrical properties required for superconductor operation at cryogenic conditions.

## INDUSTRIAL APPLICABILITY

The novel ultra-lightweight superconductor can be preferably used for technical solutions with moving and rotating parts, for example in transport and power applications, superconducting wind generators, in aerospace, train engines, in superconducting levitation drives, in space program as active shielding of human crew from cosmic radiation.

**THE INVENTORS ARE LOOKING FOR  
AN INDUSTRIAL PARTNER FOR  
SELLING/LICENSING THE TECHNOLOGY.**

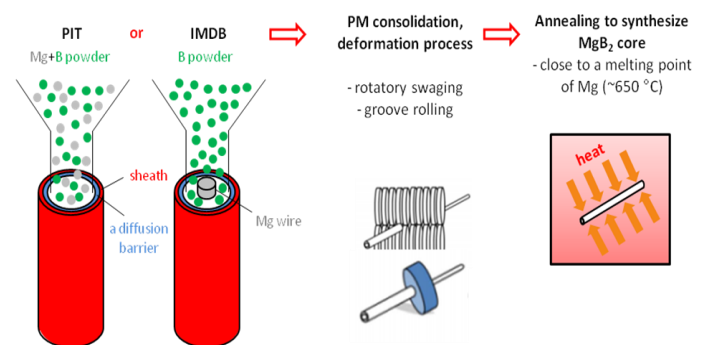
## COMPETITIVE ADVANTAGE

- **Economically meaningful fabrication process** which is feasible at a large scale.
- **Significantly lower mass of the superconductor** (at least 2.5 - 3 times less) than the standard solutions based on NbTi,  $Nb_3Sn$  and  $MgB_2$  core with an outer copper (Cu) sheath.
- **Excellent combination of mechanical properties of the superconductor at room and cryogenic temperatures** provided by the HITEMAL<sup>®</sup> sheath.
- **Good superconducting electrical properties and thermal conductivity.**

## STAGE OF PROTECTION AND DEVELOPMENT

- Priority SK patent application (PP 50037-2017).
- International application (PCT/IB2018/053540) with **excellent International Search Report**; national phases → EP, US, CN.
- Registered SK trademark: "HITEMAL".
- TRL 6 – prototype demonstration in operational environment.

## BASIC TECHNOLOGICAL PROCESS



## FOR MORE INFORMATION PLEASE CONTACT

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*The inventors use services of Technology Transfer Office of Slovak Academy of Sciences to market their invention.*