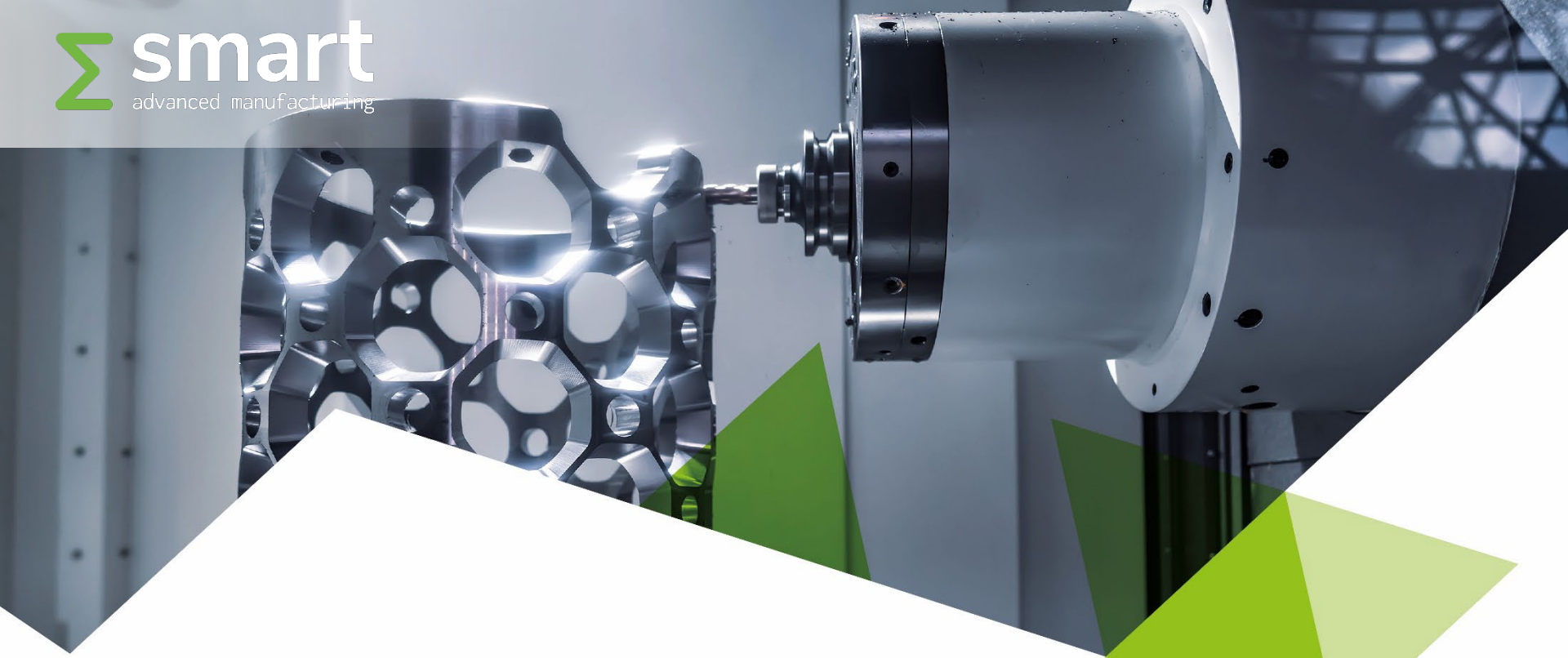
smart
advanced manufacturing



Sustainable electrical vehicle motor windings via additive manufacturing of copper (ESAM)


smart
advanced manufacturing

ORGANISATION PROFILE

KTH – Royal institute of Technology Stockholm- Sasan Dadbakhsh is an assistant professor in the department of production engineering

The Swedish Research Institute – Stacy Trey is a research in the department of Polymer materials and sustainability with 3000 employees and expertise in a wide range of areas.

PROPOSAL INTRODUCTION (I)

Vision: main project goal

1. To reach reliable powder and AM parameters to manufacture precise and reliable components 2. To create design guidelines for development of a new generation of electrical windings. 3. To create successful insulation methods 4. To understand the effect of surface roughness and post processing on the insulation and performance of windings. 5. To test the AM made windings in the lab-scale

Motivation:
Make AM windings a reality and an improvement over what is done today

Content:
. The design and possibilities of AM to manufacture copper windings are not clear. Furthermore, the copper has to match the electrical properties of conventional copper wires used in motor.
2. The feedstock powder or part properties after AM might be varied or unreliable. The geometrical precision and accuracy of AM parts
3. Another challenge associated with the AM copper originates from the fact that whole coil would be formed at once and hence, only certain stator tooth design is applicable to the winding.
4. Traditionally, motors are wound with insulated copper and then whole stator are dipped in resin for insulation. But in AM, the whole coil would be formed at once and hence, insulating copper needs to be done afterward. This creates some challenges since it is important to get uniform and adequate layer of insulation on every part of copper. 5. Moreover, the rough surfaces can increase the electrical stress between the copper turns, which could cause sparks and hence, reduce the motor lifetime.
6. The copper produced using the proposed method needs to be tested in motors, operating both electrically and mechanically in very demanding working conditions.

PROPOSAL INTRODUCTION (II)

Expected outcome:
Considering the AM profits for electric motors, one may choose to increase the motor efficiency or extract more torque (power). The estimated increase in the power could be something around 30% or efficiency in the range of 3-5 % on top of the current efficiencies which is about 90-92% (this means ~ 50% of the possible efficiency improvements can be reached via AM). Reaching these goals necessitates research and development in this direction since the climate is deteriorating rapidly, and the need of the hour is highly energy efficient and sustainable systems.

Impacts: what will be the expected market impact of the project
the power of electric motors as well as maximum recharging distance are critical factors in the growing competition between different manufacturers for developing their products.

Schedule: start and end dates for the project. Duration. 3 years

PARTNERS

Current Consortium: list of partners already involved in the project

Amnovis- Belgian ´manufacturer
Designer: Xylem
User: Scania
KTH royal institute of Technology: Academic partner to develop EBM parameters, precision, the materials, and the in- and post-process heat treatment.

Rise (Swedens Research Institute): To develop insulation with the help of
- Solvay (Italy), Also to apply Hirtisation post processing to smoothen the complex surfaces

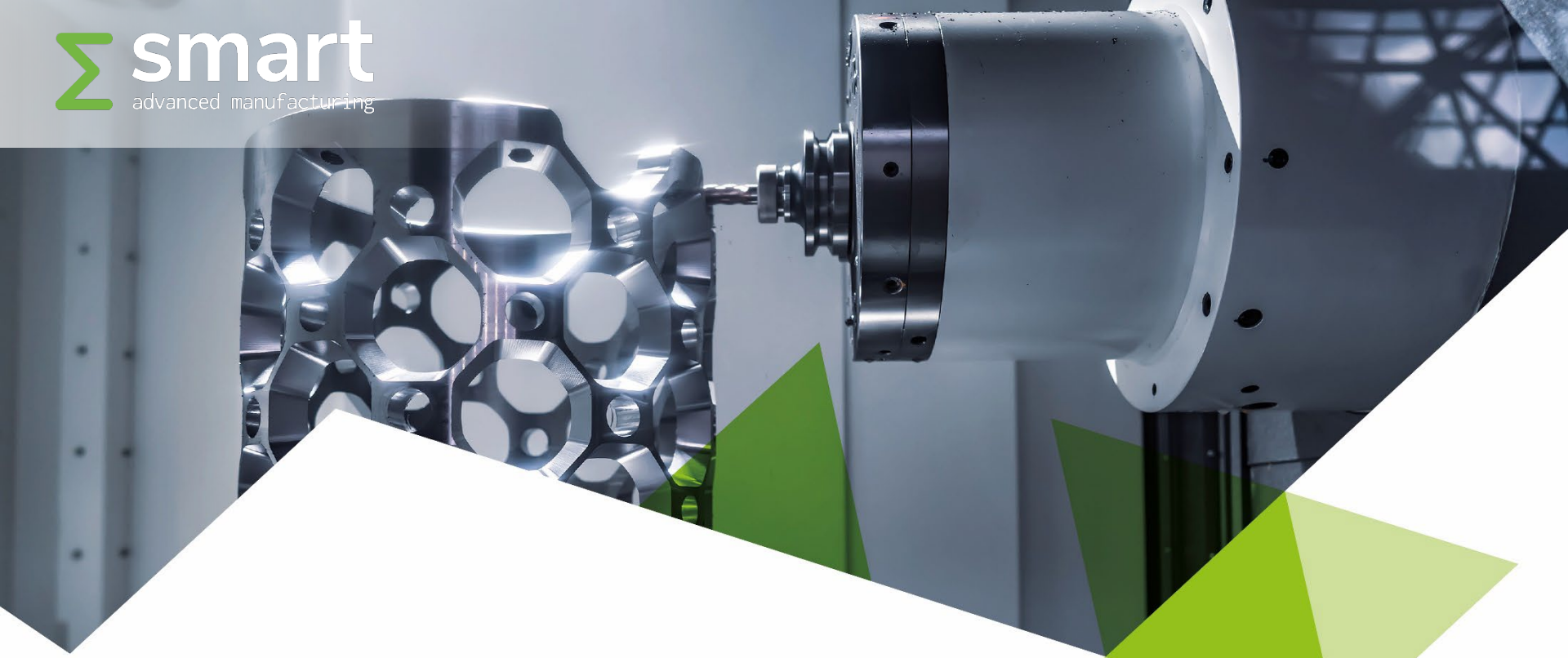
- Quality control: To monitor insulation quality with the help of KU Leuven

Partner search: type of partner searched and countries of origin (if necessary)
-small companies in Sweden working with copper and AM or a company working on plast molding insulation processes
- End users
- A manufacturer for EBM and LPBF processing
- A material producer of copper for EBM and LPBF

CONTACT INFO

Contact info: Sasan Dadbakhsh sdad@kth.se
Stacy Trey stacy.trey@ri.se

smart
advanced manufacturing



www.smarteureka.com