Towards a Greener Household: Efficient Cooling and Heating Solutions with Suitable Polymer Applications

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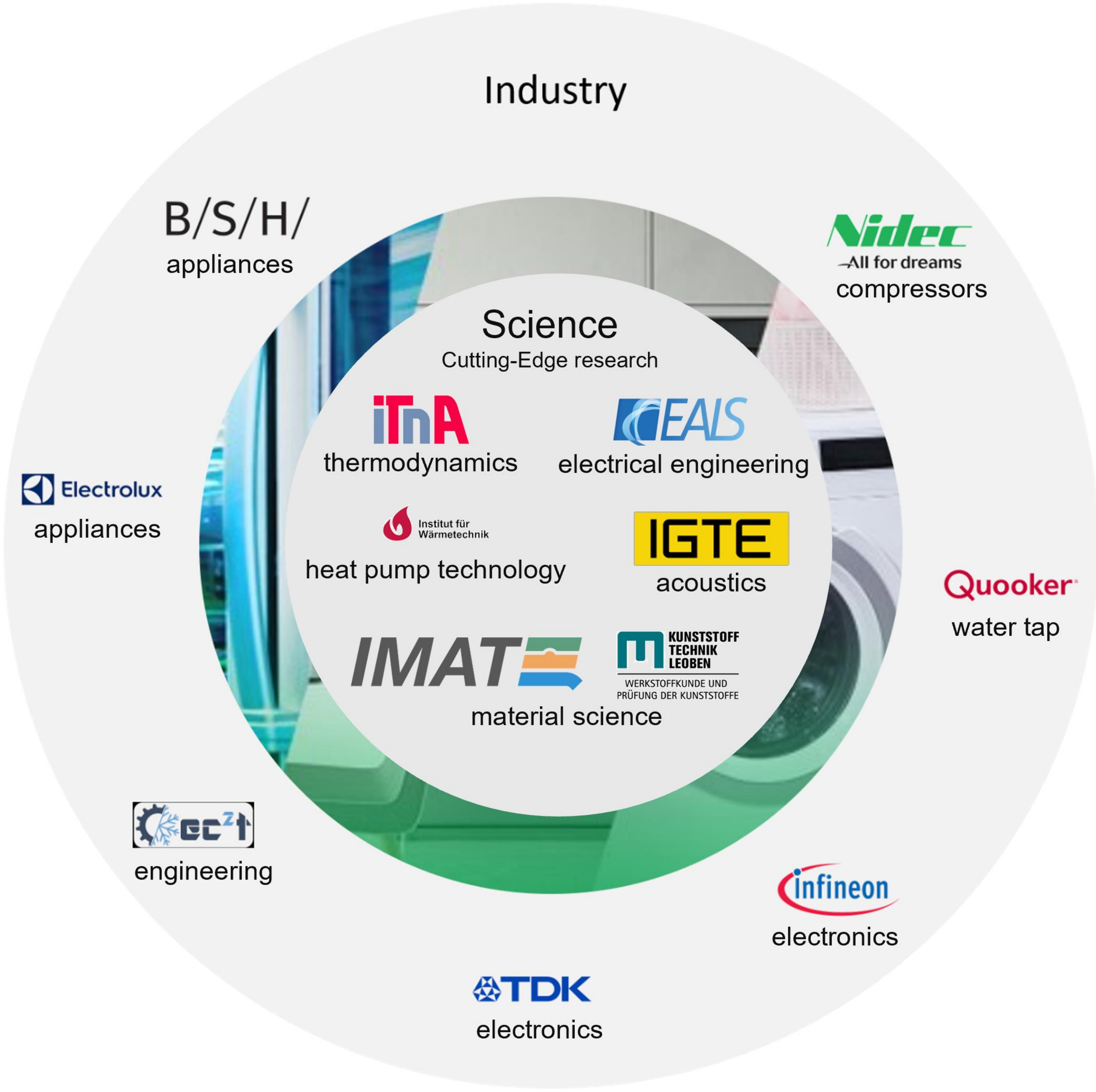
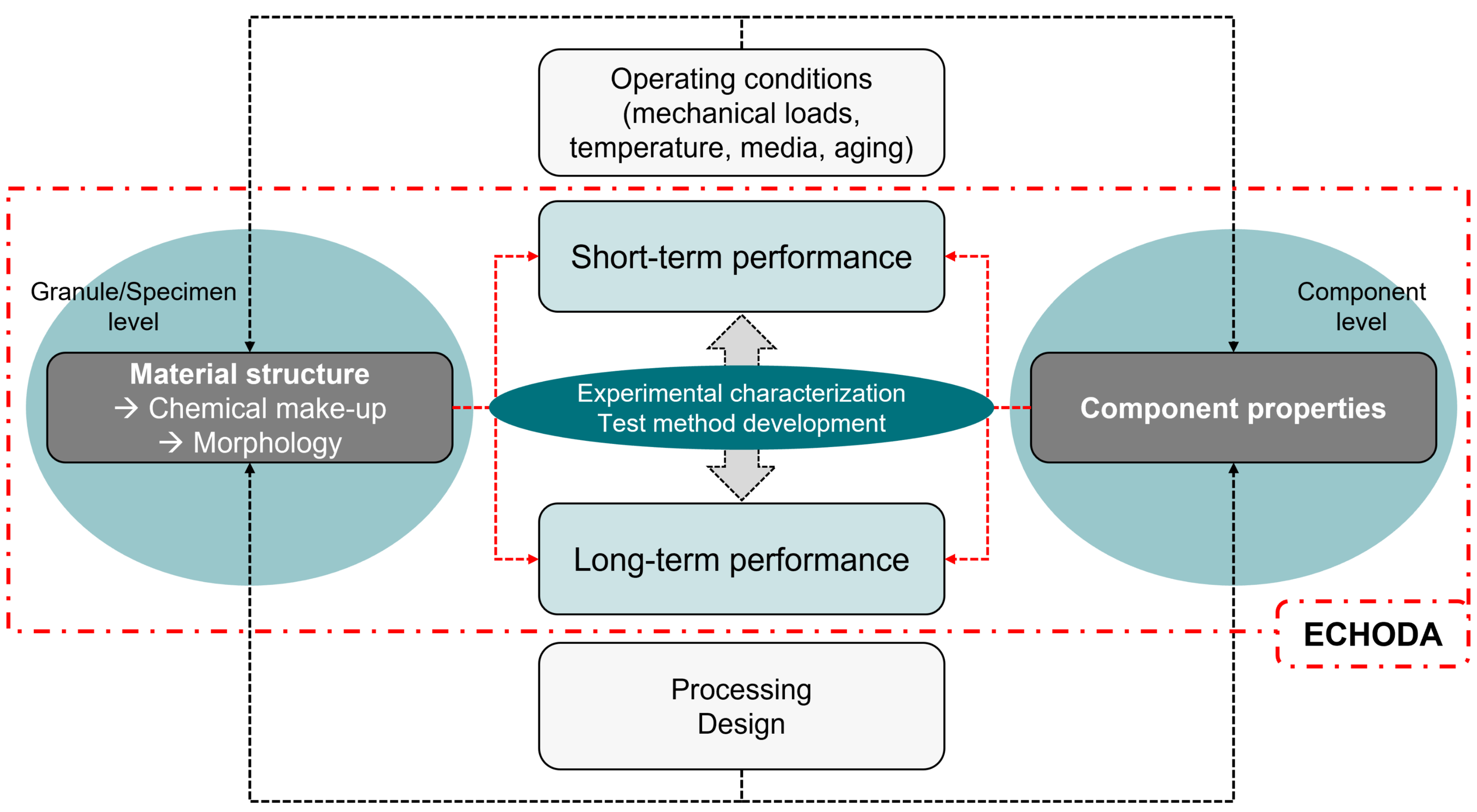
In modern households, appliances such as refrigerators, dishwashers, washing machines, dryers, small water heaters, etc. are integral to daily life, enhancing convenience and comfort. As the demand for more energy-efficient and sustainable cooling and heating solutions in these devices continues to rise, innovative approaches from scientific research and industrial development are imperative. For this reason, renowned companies from industry and universities have joined forces within the ECHODA project (Fig. 1) to drive advancements in contemporary cooling and heating technologies.

Polymer engineering has the potential to be transformative in advancing such systems. Polymers, with their viscoelastic properties and inherent damping properties, are particularly well-suited for mitigating vibration and noise in these systems. Additionally, their tunable thermal properties provide opportunities to optimize thermal management, thereby significantly improving the energy efficiency of cooling and heating systems.

…but, polymers used in such applications are often subjected to extreme environmental operational conditions, as exemplified by their use in refrigerant compressors. These conditions include elevated service temperatures, high pressures, and prolonged exposure to oils, coolants, and other media. Consequently, polymers must exhibit exceptional long-term stability in thermo-mechanical performance and resistance to aging.



Overview of the project partners within the ECHODA project.
Fig. 1.



Overall objective within the ECHODA project.
Fig. 2.

To achieve this, service oriented testing methods are essential for efficiently selecting suitable materials, tailored to the specific operational requirements of each component. These testing protocols typically encompass preliminary material selection through basic characterization techniques following accelerated aging processes, including Melt Flow Rate (MFR) assessments, Infrared (IR) spectroscopy, and mechanical short-term tests. On a service-oriented level, evaluating the long-term thermo-mechanical behavior and fracture mechanics properties is crucial to ensuring the reliable operation of these components over time.

The overall objective is to establish correlations between short-term and long-term performance data and to critically assess the relevance and limitations of basic characterization methods in predicting the long-term operational reliability of polymers in these demanding applications. This intention is shown in Fig. 2.

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