

RAMSES4CE for Circular Economy



WHAT IS RAMSES4CE?

RAMSES4CE is a smart sensor network developed for the recycling and material sorting industries. Its innovative technology combines non-destructive material detection techniques (laser-induced fluorescence (LiF), hyperspectral imagery (HSI) and Raman spectroscopy) with machine learning methods. This novel combination allows for fast, robust and reliable mapping of critical compounds in industrial wastes. Criticality is defined by dangerousness (e.g. toxic, flammable) and/or commercial value.

THE NEED

Secure raw material supply
Reduced human footprint
improved industrial recycling to enable a Circular Economy

THE CHALLENGE

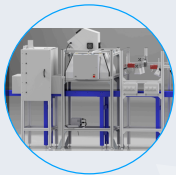
overcome time-consuming, offline material identification and adapt to increasingly complex industrial waste

THE SOLUTION

Integrated optical sensor systems for real-time mapping of recycling streams

HOW DOES IT WORK?

RAMSES4CE is a fully integrated sensor system comprised of three optical characterisation technologies:



HSI:

rapid identification and mapping of certain alloys, ceramics, and plastics



LiF:

detection of Rare Earth Elements (REEs) and plastics



Raman:

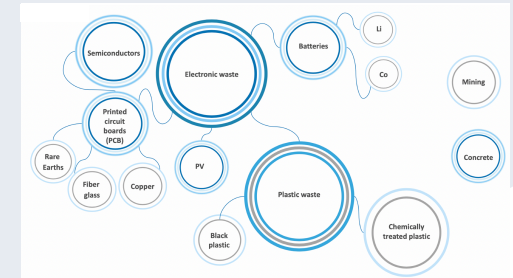
highly specific identification of organic (plastics) and inorganic compounds.

The smart sensors operate in sequential component mapping mode with immediate data fusion and result evaluation by machine learning methods.



APPLICATIONS SCENARIOS FOR RAMSES4CE

- Recycling of waste from electric and electronic equipment (WEEE)
 - printed circuit boards (PCB)
 - photovoltaic panels / semiconductors
- Recycling of plastics in various waste streams
- Recycling of batteries
 - rare-earth elements (REE)
- Re-Mining
 - rare-earth elements (REE)



ADVANTAGES OF RAMSES4CE

- Rapid and highly specific identification of materials including dictionary learning of characteristic waste types
- Operation compatible with conveyor belt speeds
- Real-time mapping of complex, inhomogeneous material streams

FURTHER INFORMATION

Upscaling project, funded by EIT Raw Materials (KIC RM 19262)

Please visit our website: www.ramses4ce.eu



THE PARTNERS in RAMSES4CE

Helmholtz-Zentrum Dresden Rossendorf
Helmholtz-Institute Freiberg for Resource Technology

TU Bergakademie Freiberg
Institute of Applied Physics

Geological Survey of Finland

Freiberg Instruments GmbH

