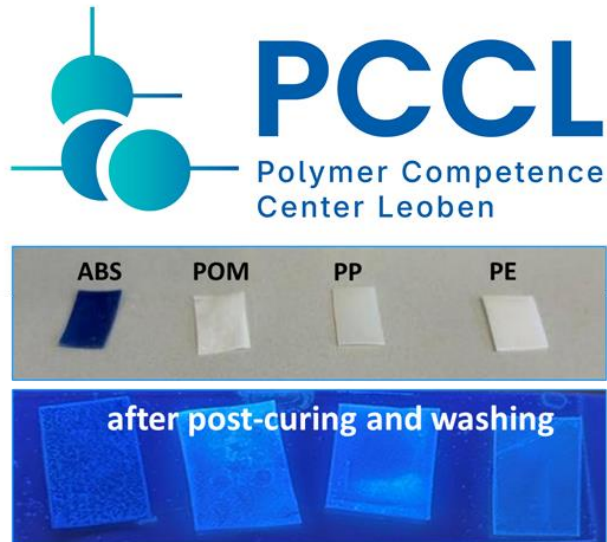


**FunPolMark  
FUNCTIONAL POLYMER  
MARKERS FOR SENSING THE  
AGING OF POLYMERS**

Programme: COMET – Competence  
Centers for Excellent Technologies

Programme line: COMET-K1 Project

Type of project: FunPolMark,  
01/2025-12/2028, strateg.



## WHEN PLASTICS GLOW: INVISIBLE INNOVATION WITH GREAT IMPACT

WITHIN THE FUNPOLMARK PROJECT, NOVEL FLUORESCENT MARKERS WERE DEVELOPED THAT CAN BE PERMANENTLY INCORPORATED INTO PLASTICS. INITIAL RESULTS SUGGEST THAT THESE MARKERS ENABLE IMPROVED ASSESSMENT OF MATERIAL CONDITION, THERMAL STRESS AND SELECTED PROCESSING HISTORIES IN THE FUTURE – EVEN IN COLORED OR HIGHLY FILLED PLASTICS. THIS CREATES A PROMISING FOUNDATION FOR NEW APPROACHES IN QUALITY ASSURANCE, PRODUCT IDENTIFICATION AND THE CIRCULAR ECONOMY.

Plastics play an essential role across almost all industrial sectors. At the same time, requirements for durability, resource efficiency and recyclability continue to grow. To recycle and utilize materials more effectively in the future, new technological solutions are needed.

This is where the COMET project FunPolMark comes in. The project aims to develop fluorescent markers that can be stably integrated into a wide range of plastic systems. In the future, these markers are intended to make information on material condition, thermal stress and processing history more readily accessible.

Within the project, coumarin-based markers were developed that can be covalently bonded to polymer chains or surfaces. Initial investigations indicate high stability, even under elevated temperatures, humid conditions, and after washing or solvent exposure. Two particularly promising integration routes were successfully explored:

*In-process functionalization:*

Markers can be incorporated directly into plastics during processing, for example during extrusion. In the long term, this offers strong potential for cost-efficient industrial implementation.

## SUCCESS STORY

### Post-process surface functionalization:

In addition, methods were developed to selectively apply markers onto plastic surfaces. In the future, this could enable localized labeling or the creation of functional sensing areas.

The results achieved so far indicate that fluorescence-based readout methods could be suitable for extracting additional information directly from plastic components. In the long term, this may open up new applications, for example in quality control, material identification, or the improved assessment of recycling streams.

FunPolMark demonstrates how industrial challenges can be transformed into innovative technologies through application-oriented research.

### Impact and effects

#### *Economic perspectives*

- Potential for new products in the field of smart materials

- Perspectives for more efficient quality control
- Possible competitive advantages for industrial partners through innovative functionalization technologies
- New application fields in recycling and material tracking

#### *Ecological perspectives*

- Long-term support for a more efficient circular economy
- Improved separation and identification of plastics, leading to higher recycle quality
- Potential to extend product lifetimes through better condition assessment

#### *Scientific impact*

- New insights into the covalent functionalization of polymers
- Development of know-how at the interface of polymer chemistry, sensing and processing
- Basis for further research and development projects

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### Projektkoordination (Story)

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### Project partner

- Technical University of Graz, Austria
- Silicon Austria Labs GmbH, Austria

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