UNIVERSITÄT DUISBURG ESSEN

Offen im Denken

REACTIVE FLUIDS
Institute for Energy and Materials Processes

Bachelor/Master Thesis

Investigation of Förster Resonance Energy Transfer (FRET) for the Detection of Hetero-Aggregates

Background

Hetero-aggregation involves bringing two different materials, A and B, into physical contact to form AB hetero-aggregates. These AB hetero-aggregates exhibit unique physical properties that can be tailored for various applications. For example, hetero-aggregates play a significant role in energy storage for Li-ion battery anodes, enhancing battery performance and extending the usage time of devices like smartphones and electric cars. AB hetero-aggregates are synthesizes by mixing two aerosols A and B. Where does mixing of A and B occur as well as how efficient the mixing is are key questions you will address

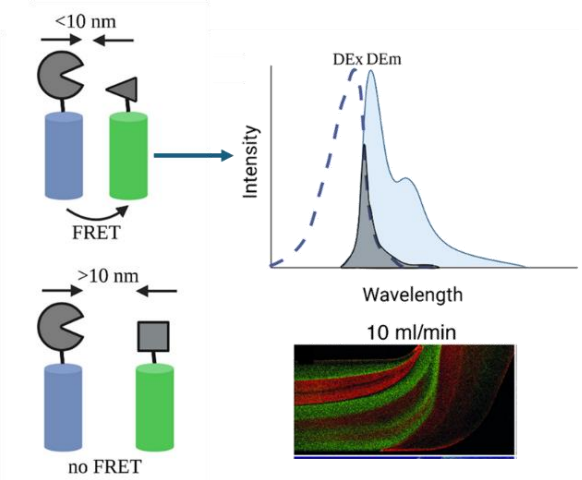

Figure 1: FRET concept and example of its application in a microfluidic channel.

Förster Resonance Energy Transfer (FRET) is utilized to investigate the mixing processes. FRET involves the interaction between two different dyes: a donor dye and an acceptor dye. When these dyes are brought close to each other (within 1–10 nm, see Fig. 1), the donor dye, when excited by a laser, transfers energy to the acceptor dye, causing it to emit light. This light emission shifts towards longer wavelength and is only observed when the dyes are in close contact (see Fig. 1 lower right image). The intensity of the light emission depends strongly on the distance between the dyes, making FRET an effective "spectroscopic ruler" and therefore presents a potential method to address the key questions.

Tasks

Your tasks include evaluating suitable donor and acceptor dye pairs based on literature data, producing AB hetero-aggregates using experimental hardware, and testing different conditions to optimize the FRET signal. These steps aim to develop a method for detecting and imaging AB hetero-aggregates in aerosol processes.

Requirements

Degree in engineering, physics, or chemistry; interest/basic knowledge in optics, imaging, and measurement technologies; and enjoy experimental work. Initiative and ability to work in a team are expected.

Language requirements: German and/or English

Contact

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