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Measuring the energetic transferring involved in microwave recycling process of fiberglass reinforced polyester matrix.

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Before the increase in demands for efficiency in production lines, the usage of composite materials was broadly spread across manufacturing facilities due to its high stability and wide range of physicochemical proprieties and applications. In this setting, fiberglass reinforced polyester matrices have been gaining notoriety as a viable option in the field of structural materials, for their expressive mechanical strength and low production cost. However, its mixture of different materials transforms the composite into an environmental problem, due to the complex recycling process needed for its reuse. Therefore, finding efficient and sustainable methods for the recycling of this material turns out to be necessary, because of its expressive amount of applications in recent years. As such, a process that induces the pyrolysis of the resin by the usage of microwaves (microwave-assisted pyrolysis process) was developed. It works by thermally acting in the disruption of the cross-link bonds that make up the molecular structure, resulting in the degradation of the orthophthalic polyester. In return, the fiberglass free of resin is acquired, besides sub-products that have direct applications in the industry, such as styrene (C8H8) and benzene (C6H6). After the realization of tests using thermal reactors and mass spectrometry sensors, the viability of this recycling process was validated. Aiming to acquire more insight into the structural degradation of the orthophthalic polyester, this work centers around mapping the energetic trades involved in the recycling route, be it related to the absorption of energy by the molecules or its liberation as a result of the covalent bond breakage. Preliminary experimental results using microwave reactors show that, in fact, it is possible to direct 740 W of energy in composites over one gram, with the recycling process being completed in less than one minute. By this, the usage of microwave-assisted recycling is expected to consume an equivalent, if not less, amount of energy than the thermal recycling largely used in modern industry. As such, there is hope to reinforce the usage of this procedure in the industrial environment; as well as applying the recycling route to other materials still considered environmental issues, technically and economically making their manufacturing processes viable.