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The use of microwave irradiation to reduce activation energy

This paper explores the use of microwave irradiation to reduce the activation energy of various reactions. The conclusions show that the activation energy was decreased substantially through mechanisms that challenge the pre-existing belief that microwave irradiation is equivalent to a heating method. Instead, microwave irradiation both increases the temperature *and* interacts with the chemical reaction system to reduce the activation energy. When microwave irradiation affects chemical reaction systems, the energy level and rotational energy level of molecules changes. These changes reduce the activation energy required for reactions, especially those that involve polar compounds.

By reducing the activation energy in various capacities, microwave irradiation can increase the rate at which elementary reactions take place, particularly the slowest, rate-determining step. Moreover, these results are achieved at lower input energy than would otherwise have been achieved by simply increasing the temperature of the reaction to the same temperature. The results imply that microwave irradiation is a more energy-efficient method to decrease the activation energy of reactions and, by extension, their reaction rate. Microwave irradiation's efficiency could be leveraged in chemical labs and in commercial products to use less energy (and by extension the source of that energy like fossil fuels) to achieve identical results.