Negative Temperature Programming using Microwave Gas Chromatography

by

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(ABSTRACT)

The microwave region of the electromagnetic spectrum lies between the infrared radiation and radio frequency region and corresponds to wavelengths of 1 cm to 1 m (frequencies of 30 GHz to 300 MHz respectively). Gaisford and Walters developed the microwave GC oven in 2000, which operated at 919 MHz. The microwave GC oven has been engineered to generate a uniform microwave field around an open tubular capillary column with elimination of cold spots which are common in a domestic microwave oven. Only the column is heated in a microwave GC oven. In microwave GC, ramp rates in excess of 6 ºC/sec, isotherms as high as 450ºC, and 1-min cool-down times from 300 to 50℃ can be achieved. In conventional GC, only positive temperature programming is used because the oven cools down slowly due to the great thermal mass of the oven. Short cool-down time in microwave-heating GC makes it possible to employ negative temperature programming for the separation of compounds during the process.

The theory and feasibility of negative temperature programming in microwave GC were investigated in this research. Negative temperature programming was employed to analyze and quantitate four different critical pairs of non-volatile and volatile compounds. The influence of cooling rate, holding time, and reheating rate in negative temperature programs for enhanced resolution were investigated. The results obtained from negative temperature programming were compared to those from positive temperature programming. Negative temperature programming afforded greater resolution of critical pairs of analytes.

This thesis is dedicated to my husband, Song, my grandma, Cuie Wang, and my parents, Meifen Wu and Youguang Bao

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