

## Microwave Chemistry Reactor

### Abstract

In the course of investigations into microwave assisted chemical reactions, problems were encountered due to the reaction scale upon which many commercial reactors are currently operating. Obtaining reasonable quantities of material (above 10 g) became laborious and it was also discovered that many solvents with low dielectric absorption were heated due to the ferrite core of the stirrer bar heating up. Design, simulation and testing of a small spherical shaped reactor, suitable for a 250 ml flask size, was constructed and used in ongoing synthetic work. Microwave suppression was incorporated in the top of the sphere, allowing powers of up to 1.5 kW to be used without any microwave leakage. The findings were in agreement with simulated results, which showed that the leakage was below detection ( $1 \text{ mW/cm}^2$ ) from the top, and the detected  $2 \text{ mW/cm}^2$  at the junction was reduced to below  $1 \text{ mW/cm}^2$

Keywords: Chemistry, Microwave, Microwave Chemistry Reactor

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### Reactor Design



Figure 1. Warlock Engineering Applicator Model: MDV2.4

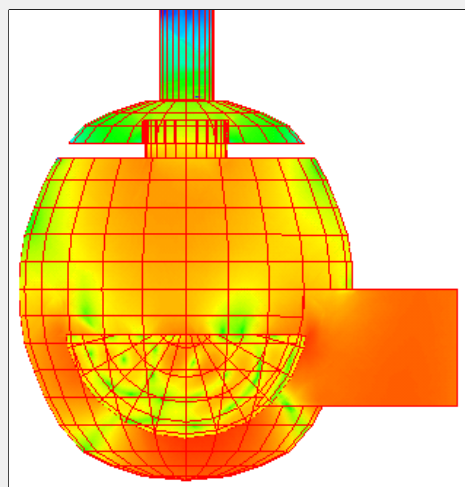


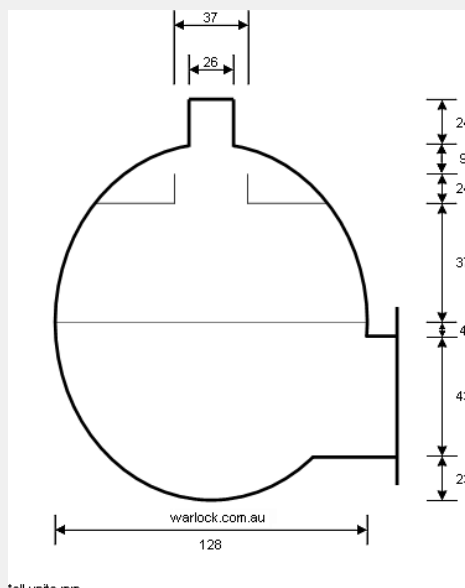
Figure 2. Simulation of microwave irradiation of DMF (120ml).

A number of holes were included so that the reaction could be observed through the side of the sphere and in future development more viewing holes will be included to give the user a clear view of the reaction in progress. Variable power was provided by a 2450MHz, 0 - 700 Watt microwave generator (2m172). Magnetic stirring was achieved by ferrite stirrer beneath the applicator, with a teflon coated follower inside the vessel. Further developments are in progress.

A prototype of the microwave setup has been on trial for the preparation of synthetic fragrances. The successful preparation of Calone 1951® has demonstrated this apparatus to be an efficient design for preparative organic chemistry when microwave accelerated synthesis is utilised.

Specifications	
Frequency	2450 MHz
Power	1 - 1500 W
Load	250 mL Round Bottom Flask

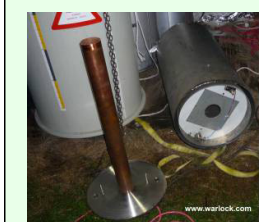
Figure 3.  
Warlock Engineering  
Applicator Model: MDV2.4



\*all units mm

### Related Publication

1. Microwave assisted synthesis of the fragrant compound Calone 1951. B. Drevermann, A. Lingham, H. Hugel, P. Marriott. *Tetrahedron Letters*, 2005, 46, 39-41. [doi:10.1016/j.tetlet.2004.11.045](https://doi.org/10.1016/j.tetlet.2004.11.045)



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- [Dielectric 'Loss Factor' \( \$\epsilon''\$ \) Measurement Over RF Frequencies Between 0.1 - 40.0 GHz for Common Organic Chemicals \[HTML\]](#)
- [Deconstruction of a 300 MHz Cryomagnet for NMR Spectroscopy \[HTML\]](#)