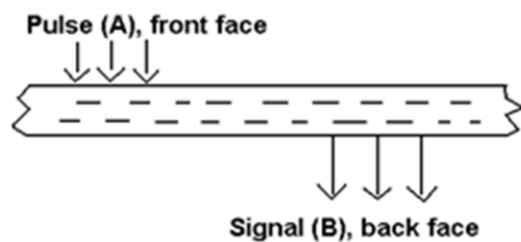


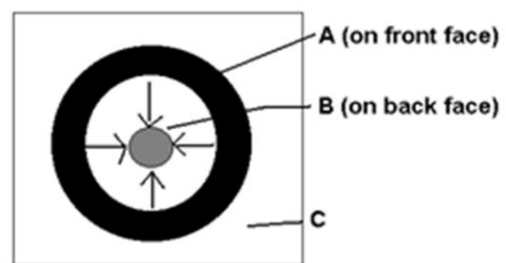
## Validation of the In-Plane Testing Procedure for the Discovery Flash Diffusivity Instrument

### INTRODUCTION

Thermal diffusivity determination on thin, high diffusivity samples using the flash method is extremely difficult. For this reason an offset method was developed that forces the heat pulse to travel partially along the plane of the sample for a predetermined distance, before the thermogram is derived from the temperature rise on the rear face (Figure 1).



**Figure 1**



**Figure 2**

The Discovery Xenon Flash (DXF) System uses a uniquely defined concentric pattern (A) which generates an intensified signal (B) as shown on Figure 2. As a result the shape and size of the sample (C) beyond the pulse input area (A) is of no consequence (square or round). An algorithm was developed to describe the process and to allow calculation of thermal diffusivity from the thermogram obtained in this fashion.

### VERIFICATION

To verify the validity of the procedure described above, two differently-shaped samples were produced from the same aluminum block. One sample was tested in the conventional (straight through) and two samples in the offset (in-plane) mode. The conventional sample was 0.500 inch diameter and 0.15 inch thick. This became the control specimen. It was tested in a Discovery Laser Flash (DLF-2) laser-based system. Two other samples, 1.25 inch diameter, 0.0285 inch thick and 0.0130 inch thick respectively were tested in the DXF system in the offset mode. Results are tabulated on the next page.

### CONCLUSIONS

It has been verified that thin high diffusivity samples can be tested with the concentric offset (in-plane) method, independent of sample thickness. The result show for independent tests grouping within 3% standard deviation as compared to an identical composition standard sample tested by conventional method.

**Test Results (at ambient temperature)**

|                       | <b>Sample 1</b> | <b>Sample 2</b> | <b>Sample 3</b> |
|-----------------------|-----------------|-----------------|-----------------|
| <b>Diameter (in)</b>  | 0.500           | 1.250           | 1.250           |
| <b>Thickness (in)</b> | 0.1500          | 0.0285          | 0.0135          |
| <b>Method</b>         | standard        | offset          | offset          |
| <b>Mask No.</b>       | N/A             | 875             | 875             |

**Thermal Diffusivity (cm<sup>2</sup>/s)**

|               |        |        |        |
|---------------|--------|--------|--------|
| <b>Test 1</b> | 0.7776 | 0.8072 | 0.7970 |
| <b>Test 2</b> | 0.7509 | 0.7830 | 0.7708 |
| <b>Test 3</b> | 0.7587 | 0.7991 | 0.7727 |

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