A novel approach to measure the convective heat transfer coefficient based on pulse heating

Zujun Peng1, Ying Chen1, Xue Feng\*2, 3

1. Institute of Flexible Electronics Technology of THU, Zhejiang

2.AML, Department of Engineering Mechanics, Tsinghua University, Beijing, China

3.Center for Flexible Electronics Technology, Tsinghua University, Beijing, China

Abstract

Convective heat transfer coefficient (CHTC) is a significant quantity that is needed for the thermal system design. This paper proposes a novel approach to estimate the CHTC through pulse and isothermal heating. The ideal isothermal heating process has been realized through multi-layer structure design, which has been fully validated by the finite-element model and thermal imaging experiment, even for specimens with low thermal conductivity. Moreover, based on the simulation model, we analyzed the thermal response law of multilayer structure and obtained the optimization design criteria. During pulse heating, convective heat transfer coefficient can be simultaneously estimated using the proposed method, and the relative numerical errors will be less than 5.5% with virtual temperature data. Finally, we prepared the flexible CHTC sensor, and obtain consistent results with a coefficient of variation no more than 0.02 through different data, which further verifies the effectiveness of the method.

**Keywords**: Convective heat transfer coefficient; thermal; sensor; flexible