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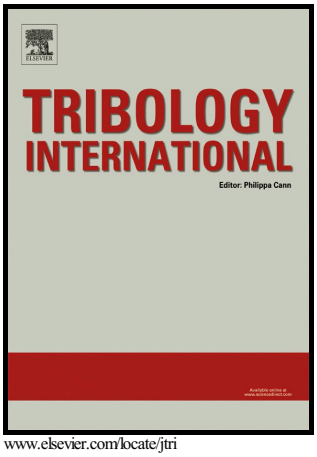

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In-situ observation of temperature rise during scratch testing of poly (methylmethacrylate) and polycarbonate

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Abstract: In this work, an in-situ observation of temperature rise during the scratch test was performed for both brittle and ductile polymeric materials, i.e., poly (methylmethacrylate) (PMMA) and polycarbonate (PC). Significant temperature rise of the scratched polymer substrate has been observed for both PMMA and PC, though their scratch damage modes are quite different. Frictional heating is the main reason of the temperature rise under the low scratch normal load, while the plastic deformation and severe damage are responsible for the temperature rise under high load level. Since the DSC results clearly show that the microstructures of PMMA and PC are altered, the temperature rise during the scratch process has to be considered for the further investigation of polymer scratch.

Keywords: Polymer; Scratch; Temperature rise; In-situ observation

1. Introduction

Polymeric materials have been widely consumed in automotive industry, data storage and optical products, etc. The scratch behavior of polymeric materials has drawn much attention due to their low resistance to surface deformation and damage [1-10]. Various scratch damage modes of polymeric materials have been observed [11-16]. Fish-scale and material removal have been observed for PP [16, 17] and TPO [18, 19]. Parabolic crack has been found during the scratch test of PS [20], epoxy [21] and diethylene glycol bis(allylcarbonate) [22]. Three different damage modes have been recognized for PMMA scratch under the progressive loading [23]. Cracking has also been discovered for polymer coating scratch [24-26]. Based on the experimental observation following the ASTM and ISO test standards [27, 28], Jiang et al. [29]