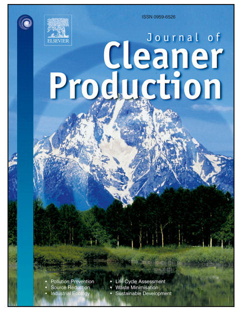
Accepted Manuscript



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PII: S0959-6526(15)00690-3

DOI: 10.1016/j.jclepro.2015.05.111

Reference: JCLP 5625

To appear in: *Journal of Cleaner Production*

Received Date: 11 July 2014

Revised Date: 22 May 2015

Accepted Date: 22 May 2015

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ABSTRACT

In the context of building a sustainable future by reducing fossil energy consumption with the objective of minimizing detrimental climate change, particular attention was given to minimizing the complexity, energy consumption and environmental impact of microstructures manufacturing. In this work a new fast-fabrication process for microelectromechanical systems is presented. The name of this new fabrication process is KISSES for *Keep It Short, Simple and Environmentally Sustainable*. Combining classical deposition techniques (with common metals and polymers and with less common materials such as tree resins, paper and glue), release techniques and a computer numerical control cutting machine, a two-dimensional fabrication process has been developed and the first steps of three-dimensional microfabrication have also been initiated. In order to test this new process, various test structures have been fabricated and tested. These include resonant structures with electronic actuation and electronic measurement, having good quality factors for plastic-based devices, and high-resolution masks (~10 µm) which can be used, for example, for screen-printing techniques. Finally, a temperature sensor and a viscosity sensor have been designed, fabricated with the KISSES process and characterized. These devices exhibit, respectively, a limit of detection of 0.112°C and a viscosity estimation error of less than 10% for viscous silicone oils from 5cP to 50cP. These characterizations of the microdevices show that the proposed process provides a simple method that is capable of fabricating devices that function with high performance. The aim of developing a rapid, simple and environmentally sustainable process has therefore been demonstrated.

Keywords: microelectromechanical system, fabrication, prototyping, low cost, environmental impact, cleantech

1. INTRODUCTION

One of the interests of soft electronics is the reduction of the energy cost which is sometimes related to improved environmental compatibility. In recent years organic electronics have emerged as a viable means of replacing expensive inorganic materials with soft polymers. For instance, organic LED, flat screen displays and electronics paper are now efficient, stable and currently available, already representing in its infancy a 3 billion dollar market (Opera project, 2009). In the near future, organic transistors, solar cells and microelectromechanical systems (MEMS) are expected to follow a similar trend of growth (Opera project, 2009). The fabrication of organic electronics requires less energy than silicon technology (Sheats, 2004). For instance, in the field of organic solar cell technology, the Energy Pay-Back Time (EPBT) can be reduced to less than one