Fabrication of biopolymer cantilevers

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INTRODUCTION

Over 200 million tons of plastic is manufactured every year but only 12 million is recycled, mostly because the rest is cluttered with food scraps etc. but cannot be composted since ordinary plastic often needs 100-1000 years to degrade. By using biodegradable bioplastic instead this huge amount of garbage can by composted and reused as topsoil in industrial farms and home gardens.
Even with this obvious benefit of bioplastic the world market was only around 0.085 million tons in 2006, mainly because bioplastic is still a niche market and not price competitive with ordinary fossil fuel based plastics. One way to lower the cost of bioplastics is to lower the R&D expenses, this will also allow for the development of more different bioplastics with distinct properties e.g. it only will dissolve in specific environments. A big burden in today's development of bioplastics is the measurement of the degradability, this is done by putting a bulk of your bioplastic in a compost heap, dig it up and weight it periodically throughout many months to measure how much have been decomposed.

THE SOLUTION

With our novel production method biopolymer micro cantilevers can be manufactured cheap and easily, rendering the measurement of degradability a matter of a few days. Our micro cantilevers are made of the PLLA (poly-l-lactide), measure 100 x 500 x 10 µm (width, length, height) but are positioned on a supporting body chip to allow handling with tweezers. As biopolymers are to fragile to process with standard silicon techniques we developed a fabrication method using nanoimprint lithography, where the chip structure is defined by pressing a stamp into the biopolymer layer. This has previously only been done with ordinary plastics.
The degradation is then evaluated by placing the chip in a solution and measuring its resonance frequency, which depend on the cantilever mass. As proof of concept this measurement was also performed.

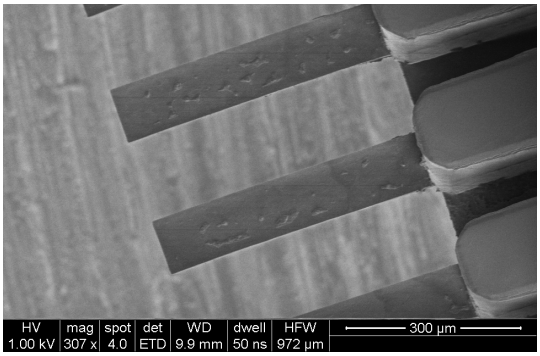

Figure 1: SEM image of PLLA cantilevers after chip release. The support structure is visible to the right.