

Flexible piezoelectric materials for smart textile application

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Abstract

Smart textile materials become more and more popular nowadays and are widely used in various areas, allowing incorporation of built-in technological elements into everyday textiles and clothes.

Recent progress in development of new materials such as flexible piezoelectric materials opens a new opportunity for smart textiles by incorporating active devices such as buzzing elements or motion sensors into the garments. Nowadays, there are a number of piezoelectric polymer materials available (e.g. polyvinylidene fluoride (PVDF) family materials) that can be incorporated into textile, however, such polymer materials typically show relatively low piezoelectric activity and therefore the practical application of such materials is limited.

The present work is devoted to the development of flexible piezoelectric materials on the basis of piezoceramic materials dispersed into polymer matrix. The newly developed materials (PiezoPaint™ material) combine an increased piezoelectric activity (d_{33} coefficient more than 35 pC/N), extremely low processing temperatures (< 100 °C), and high flexibility in the cured state. The materials developed are also compatible with screen- and pad- printing technology and therefore can be easily applied to a variety of textile materials and fabrics.

A number of prototypes, including the piezoelectric buzzers and motion sensors have been fabricated on the basis of flexible PiezoPaint™ materials, printed onto different textiles. The results obtained clearly show that the functional piezoelectric materials such as PiezoPaint™ that are compatible with textile production open new prospects in terms of developing intelligent clothing and smart garments.