

Design Research of Nanopositioner based on SPM and its simulation of FEM

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Abstract: A novel nanopositioning stage was designed according to the scanning property of SPM with flexure hinge as kinematic structure and piezoelectric ceramic as actuator. Kinetic precision and X directional area of nanopositioner are 1.55nm and 26.4 micron, respectively, which is demonstrated by kinetic analysis and finite element method FEM simulation. Designed nanopositioner based on SPM moves at 3 dimensions with nanometer scale and its motion of X, Y, and Z directions is decoupled and isotropic. Furthermore, frame of nanopositioner is simple and manufacturing is convenient, which will have broad prospect in the field of nanopositioning and nanotracing.

I. Introduction

Fracture of some nanomaterials at nanometer scale has no rule in the nanomeasurement and nanocharacterization. Scanning probe microscope SPM is in need to conduct nanocharacterization, that is to say that SPM with nanopositioning stage, but general SPM has no this kind of function. When user of SPM is interested in some corner of scanning image, he has to reduce the height of probe to renew the experiment as range of scanning approach the limit, but the experiment will fail without the help of nanopositioning stage. For a larger range of scanning tube, as the range increases, resolution of image decreases, which introduces bigger errors. At present, SPM with nanopositioning stage is precious, so research of novel nanopositioner with low price has broad prospect in the market and application value.

2 Design of nanopositioner based on flexure hinge of 6-PUU



Fig.1. CSPM-930b SPM

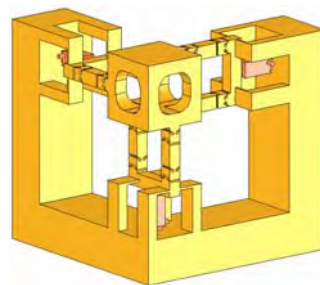


Fig.2. Nanopositioner based on flexure hinge structure

Flexure hinge with high accuracy, repeatability, frictionless function has been used in nanopositioner [1-4]. Designed nanopositioner with nanometer resolution of 3D can conduct the function of nanotracing and nanopositioning. According to the property of SPM scanning,