

Triassico: A Sphere Positioning System for Surface Studies with IBA Techniques

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We propose here a novel technique to microscopically study the whole surface of millimeter sized spheres. The sphere dimensions can be from 1 mm; the upper limit is defined only by the power and by the mechanical characteristics of the motors used. Three motorized driving rods are arranged so an equilateral triangle is formed by the rod's axes, on such triangle the sphere sits. Movement is achieved by rotating the axes with precise relative speeds and by exploiting the friction between the sphere and the axes surfaces. The sphere can be held in place either by gravity or by an opposing trio of axes. By rotating the rods with specific relative angular velocities, a net torque can be exercised on the sphere that will rotate. No repositioning of the sphere or of the motors is needed to cover the full surface with the investigating tools. There are no fixed positions on the sphere so a continuous movement with no blind spots can be achieved. An algorithm, that takes into account the kinematics constraints, was developed. The algorithm minimizes the number of rotations needed by the rods, in order to efficiently select a particular position on the sphere surface. The Triassico was initially developed for the National Ignition Facility, of the Lawrence Livermore National Laboratory (Livermore, California, USA), as a sphere manipulation apparatus for R&D of the DT inertial confinement fusion fuel spheres. Other applications span from samples orientation, ball bearing manufacturing, or jewelry.

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