CLAIMS:

1. An automated method for removing a foreign particle from a surface of an object, the method comprising the steps of:

gripping a particle removal tool with a tool gripper which is operatively connected to an alignment actuator, a tip of the particle removal tool including a sticky tip portion, the sticky tip portion further having an apex region at a remote end of the sticky tip portion and a flank region adjoining the apex region;

driving the tool gripper with the alignment actuator to tilt the particle removal tool at an oblique angle with respect to the surface so that the flank region of the particle removal tool faces towards the surface;

conveying the tilted particle removal tool with the tool gripper to contact the foreign particle on the surface with the flank region of the particle removal tool and exerting a force onto the surface to attract the foreign particle onto the flank region; and

lifting the particle removal tool away from the surface with the tool gripper to remove the foreign particle from the surface.

2. The method of claim 1, wherein the particle removal tool has a longitudinal axis, and the method further comprises the step of rotating the tilted particle removal tool with the tool gripper about the longitudinal axis so as to position an unused portion of the flank region of the particle removal tool to face the surface, and lifting another foreign particle away from the surface.

3. The method of claim 1, further comprising the step of driving the particle removal tool with an XY driving mechanism coupled to the tool gripper to scrub the surface with the particle removal tool for attracting the foreign particle onto the flank region.

4. The method of claim 1, wherein the particle removal tool is gripped by the tool gripper when the particle removal tool is stored at a cleaning tool station containing a supply of multiple particle removal tools.

5. The method of claim 1, further comprising the step of determining a position of the apex region of the tilted particle removal tool with an optical device prior to conveying the particle removal tool to contact the foreign particle.

6. The method of claim 1, wherein the sticky tip portion of the particle removal tool comprises a gel-like substance attached to one end of a stick.

7. The method of claim 1, further comprising the step of applying a force in predetermined increments until a threshold force is exerted on the foreign particle by the particle removal tool for attracting the foreign particle onto the flank region.

8. An apparatus for automatically removing a foreign particle from a surface of a fragile object, the apparatus comprising: an alignment actuator and a tool gripper operatively connected to the alignment actuator,

wherein the tool gripper is configured and operative to grip a particle removal tool, a tip of the particle removal tool including a sticky tip portion, the sticky tip portion further having an apex region at a remote end of the sticky tip portion and a flank region adjoining the apex region,

the alignment actuator is operative to drive the tool gripper to tilt the particle removal tool at an oblique angle with respect to the surface, so that the flank region of the particle removal tool faces towards the surface, and

the tool gripper is further configured and operative to convey the tilted particle removal tool to contact the foreign particle on the surface with the flank region of the particle removal tool and exert a force onto the surface to attract the foreign particle onto the flank region, and to lift the particle removal tool away from the surface to remove the foreign particle from the surface.

9. The apparatus of claim 8, wherein the tool gripper arm has a longitudinal axis, and the alignment actuator operatively connected to the tool gripper for rotating the tool gripper about the longitudinal axis of the tool gripper arm so that the particle removal tool is tiltable to an oblique angle with respect to the surface of the object.

10. The apparatus of claim 9, wherein the particle removal tool has a longitudinal axis, and the tool gripper further comprises a rotary motor for rotating the tilted particle removal tool about the longitudinal axis of the particle removal tool, so as to position an unused portion of the flank region of the sticky tip portion to face the surface of the object.

11. The apparatus of claim 10, wherein the longitudinal axis of the arm is substantially perpendicular to the longitudinal axis of the particle removal tool.