

CLAIMS

What is claimed is:

1. A self-aligning tip system comprising:
 - a tip holder comprising, a threaded section disposed on a distal end thereof, and a hollow inner cavity;
 - a lockable swivel collar disposed in the hollow inner cavity of the tip holder, the lockable swivel collar comprising a central aperture configured to retain a tip; and
 - a locking cap comprising a central aperture configured to allow a tip to pass therethrough, wherein the locking cap is configured to be threaded onto the threaded section of the tip holder and to retain the lockable swivel collar inside of the inner cavity of the tip holder,wherein, when the locking cap is installed loosely, a tip retained in the lockable swivel collar is allowed to swivel in roll, pitch and yaw while maintaining accurate theta registration, and

wherein, when the locking cap is installed tightly, a tip retained in the lockable swivel collar is locked in terms of roll, pitch and yaw, wherein the lockable swivel collar comprises swivel ball profiles on top and bottom sides thereof and wherein the tip holder and locking cap comprise corresponding swivel ball profiles on a bottom portion and a top portion thereof, respectively,

further comprising a spring disposed between the lockable swivel collar and locking cap, and

wherein the spring is configured to bias a tip held retained in the lockable swivel collar to a neutral position.
2. The self-aligning tip system of claim 1 wherein the tip holder comprises an upper section configured to be retained in a die bonding system.

3. The self-aligning tip system of claim 4 wherein the locking cap and lockable swivel collar comprise spring seats configured to locate the spring.

4. The self-aligning tip system of claim 4 further comprising a magnet disposed in the tip holder.

5. The self-aligning tip system of claim 7 wherein the magnet is configured to bias a tip held retained in the lockable swivel collar to a neutral position.

6. The self-aligning tip system of claim 1 further comprising a magnet disposed in the tip holder.

7. The self-aligning tip system of claim 9 wherein the magnet is configured to bias a tip held retained in the lockable swivel collar to a neutral position.

8. The self-aligning tip system of claim 1 wherein the self-aligning tip system is configured such that tip alignment occurs with the center of rotation located at the bottom of a die held by a tip retained by the lockable swivel collar.

9. The self-aligning tip system of claim 1 further comprising at least one air-port disposed in the tip holder.

10. The self-aligning tip system of claim 12 wherein the self-aligning tip system is configured to utilize vacuum to lock the tip into position.

11. The self-aligning tip system of claim 1 further comprising a tip retained in the lockable swivel collar wherein the tip comprises at least one air port configured to allow the transmission of positive pressure and/or vacuum from a backside of the tip to a distal end thereof, the distal end being configured to mount a die to a substrate.

12. The self-aligning tip system of claim 14 wherein with the tip in an unlocked position, the tip is configured to utilize a burst or steady stream of air through the at least one air-port disposed therein to reduce the friction associated with tip alignment.

13. The self-aligning tip system of claim 1 wherein the lockable swivel collar utilizes a clamp-collar retention system to retain a tip.

14. The self-aligning tip system of claim 1 wherein the locking cap further comprises preloaded locking tabs configured to prevent rotation of the lockable swivel collar relative to the self-aligning tip system, once tightened.

15. A method of planarizing a tip to a substrate, the method comprising:
using a self-aligning tip system in accordance with claim 1:

retaining a tip within the lockable swivel collar;

loosening the locking cap, thereby allowing the tip to swivel in roll, pitch and yaw while maintaining accurate theta registration;

bringing the tip into contact with the substrate; and

tightening the locking cap, thereby locking the tip in roll, pitch and yaw.