# SLOT DIE WITH ACTIVELY CONTROLLED COATING WIDTH

## TECHNICAL FIELD

The present disclosure relates to slot die coating systems and methods with actively controlled coating width for direct coating various shapes.

## BACKGROUND

Available slot die coating systems rely on highly accurate and stable die geometry and fluid delivery to produce stable coatings. Starts and stops of the coating as well as width changes may lead to non-uniform coatings. To change the width of a dispensing slot, a stationary shim inside the coating die needs to be changed, or one or more movable deckles inside a manifold or cavity of the coating die are required. Various die coating techniques are described in JP Patent Application Publication Nos. 11-333906, 2013-189011, 2002-066420, and 2002-066420.

## SUMMARY

Briefly, the present disclosure describes an apparatus that includes a die body including a cavity having an opening on a dispensing side thereof. One or more movable components are disposed on the dispensing side of the die body to define at least a portion of a dispensing slot adjacent the opening of the cavity. The one or more movable components are movable with respect to the opening to allow a width of the dispensing slot along a cross direction to be dynamically adjustable. In one aspect, the present disclosure describes an apparatus comprising: a die body including a cavity, the cavity having an opening on a dispensing side thereof; and one or more movable components disposed on the dispensing side of the die body to define at least a portion of a dispensing slot adjacent the opening of the cavity, wherein the one or more movable components are movable with respect to the opening to allow a width of the dispensing slot along a cross direction to be dynamically adjustable. In some embodiments, the one or more movable components may include one or more die lips that define the dispensing slot.

The present disclosure also describes a method of dispensing a liquid using an apparatus described herein. The apparatus includes a die body including a cavity having an opening on a dispensing side thereof. One or more movable components are disposed on the dispensing side of the die body to define at least a portion of a dispensing slot adjacent the opening of the cavity. The one or more movable components are movable with respect to the opening to allow a width of the dispensing slot along a cross direction to be dynamically adjustable. The method further includes supplying the liquid at a flow

rate into a cavity of a die body, and moving at least one of the movable components along the cross direction to dynamically change the width of the dispensing slot thereof. In another aspect, the present disclosure describes a method of dispensing a liquid using the apparatus of any one of the preceding claims, the method comprising: supplying the liquid at a flow rate into the cavity of the die body; and moving at least one of the movable components along the cross direction to dynamically change the width of the dispensing slot. In some embodiments, the method may further include adjusting the flow rate while dynamically changing the width of the dispensing slot and dispensing the liquid onto a substrate to coat fluid (e.g., a liquid patch with definite or indefinite length).

Various unexpected results and advantages are obtained in exemplary embodiments of the disclosure. One such advantage of exemplary embodiments of the present disclosure is that the width of the dispensing slot can be dynamically adjusted during dispensing liquid such that liquid coatings (e.g., discrete patches or continuous stripes) with various shapes can be directly coated on a substrate with minimum converting waste. In some cases, the dynamical width adjustment can be achieved by rapidly (e.g., at a frequency no less than 0.1 Hz) moving a movable structure or component that defines the dispensing slot back and forth along the cross direction.

Various aspects and advantages of exemplary embodiments of the disclosure have been summarized. The above Summary is not intended to describe each illustrated embodiment or every implementation of the present certain exemplary embodiments of the present disclosure. The Drawings and the Detailed Description that follow more particularly exemplify certain preferred embodiments using the principles disclosed herein.

## BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure may be more completely understood in consideration of the following detailed description of various embodiments of the disclosure in connection with the accompanying figures, in which:

FIG. 1 is a perspective view of a coating apparatus according to one embodiment of the present disclosure.

FIG. 2 is a perspective partial view of the coating apparatus of FIG. 1.

FIG. 3 is a cross-section side view taken along section lines 3-3 in FIG. 1.

FIG. 4 is a schematic view of a dispensing slot of the coating apparatus of FIG. 1.

FIG. 5 is a schematic view of a dispensing slot of the coating apparatus of FIG. 1.