How to use a Spiral Bar Coater with the Elcometer 4340 Automatic Film Applicator

When it comes to developing products such as paints, cosmetics, glues or varnishes for example; it's typical to test their properties as part of their development. It's important therefore to ensure that consistent, repeatable and reproducible films can be made in order to undertake fair and accurate tests.

Many of these films are created using film applicators, which come in many different designs, but work in effectively the same way. The product you wish make a film of is placed in front of, or inside of the applicator depending on its design, and the applicator is then moved across the substrate at a steady speed, guiding the product through a precision engineered gap, which creates a film of a defined thickness. This can be done manually, or with a motorised automatic film applicator, such as the Elcometer 4340, for increased repeatability and reproducibility.

However, there is another method, which is ideal for when you want to create incredibly thin films – the spiral bar coater.

The spiral bar coater works slightly differently to film applicators. Consisting of a cylindrical bar wound with stainless steel wire of a defined diameter; the product you wish to make a sample film of is placed in front of the bar coater and as the bar coater is moved across the substrate (again this could be done manually or automatically) the product flows between the turns of the stainless steel wire. This simulates how a coating is applied when using a paint brush. The product should then settle, or level off, to the wet film thickness defined by the bar coater. As a result, this method only works with products that have high levelling characteristics, with a low viscosity. It is best suited to materials with a viscosity range from about 1 to 1000 centipoise, subject to them flowing out after coating.

Made of stainless steel, the Elcometer 4360 and 4361 Spiral Bar Coaters are available in two widths, and are perfect for creating incredibly thin films from just 4-500µm thick.

In this video, were going to show you how to create a film using a spiral bar coater and the Elcometer 4340 Motorised Automatic Film Applicator. Alternatively, if you want to find out how to create a film using a film applicator with the Elcometer 4340, make sure you check out our separate "how to" video on that. And before we get started, for a full introduction to film application and the Elcometer 4340, make sure you check out our Introduction to Film Application video, and our Applicators Explained video, detailing the full Elcometer Film Applicator range.

To begin, place the supplied bubble level on the table, and adjust the feet of the unit, until the table is level. Next, switch the Elcometer 4340 on using the switch at the back of the machine, followed by the green button on the control panel.

Now you can set your carriage speed – in other words, how quickly the film is applied. Simply set the dial from 1 to 11, to choose your desired speed. This should only be done when the carriage is stationary, not while the carriage is moving.

With the speed set, you now set the carriage start and stop positions, which defines the length of your film. This is set using two knobs on the back of the machine. To adjust the start position, press the carriage start button, and the carriage will move to the end position. With the carriage now out of the way, you can unscrew the starting position knob, adjust its position, and then retighten.

To adjust the stop position, press the carriage return button which returns the carriage to the start, and then adjust the end position knob as before.

With the applicator's speed and distance set, it's time to add your spiral bar coater to the carriage. There three types of carriage: a film applicator carriage, a spiral bar coater carriage, and a combined film applicator and spiral bar coater carriage. As the Elcometer 4340 comes with a combined carriage as standard, we will be looking at testing with one of those in this video, but full instructions for each carriage type are available in the Elcometer 4340 instruction manual on the Elcometer website.

To fit a spiral bar coater, ensure the combined carriage is in its raised position, remove the applicator pushing bar if it's fitted, remove the weights, open the clamps, and fit the spiral bar coater. Then close the clamps. Make sure when you are closing the clamps, they are closed on the plain end pieces of the bar, not on the spiral or the weld, as this can damage the bar coater. Also, depending on the width of the spiral bar coater you are using, you may also have to adjust the horizontal position of the clamps.

Once the bar is clamped in place, refit the weights and then it's time to mount the provided rubber matt to the table. The rubber matt, also known as an impression bed, is designed to elevate the substrate to a suitable height for the spiral bar coater, while gripping both the table and the substrate. Its properties also aid the flowing out and levelling of the product once the drawdown has been completed, increasing repeatability.

Make sure the table and both sides of the soft rubber mat are clean, then place the rubber mat on the table, securing in place using the spring clamp. Next, rotate the carriage to the lower position, and check the spiral bar coater is touching the surface of the rubber mat. If it's not, simply rotate the two screws at the rear of the carriage to adjust its position.

With the spiral bar coater correctly positioned, make sure the underside of the substrate you are using is clean, then place the substrate on the rubber matt and secure using the clamp. Additionally, you may want place a thin piece of paper at the end of your substrate, between the substrate and the rubber mat, in order to catch any excess product, making it easier to clean up. You are now ready to test.

Pour your test sample in front of your bar coater, ensuring it is evenly spread across the width of the bar coater. Then with the machine on, press the carriage start button, and your film is created, with the carriage stopping automatically at the stop position.

Upon completion of the film, remove the sacrificial piece of paper, if you've used one, and immediately remove and clean your bar coater, to avoid any excess product dripping on the substrate and to avoid any product drying onto your bar coater, which could affect its performance. Then press the carriage return button, and you have your completed film. Simply repeat this process as many times as required, with the Elcometer 4340 ensuring you get the same film every time, allowing for consistent, comparable testing.

For more information on the Elcometer 4340 Automatic Film Applicator, or Elcometer's full range of applicators, simply visit Elcometer.com or click on one of the links on-screen.

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