2→3 route) was recombined with a 50/50 fiber splitter and the interference signal was detected with a balanced detector which rejected the background and the common signal noise.

Image data were collected by optical scanning in the *x*–*y* image plane (en-face) at a selected *z*-axis depth within the sample. Following the capture of a single en-face 2D image the position of the microscope objective was adjusted to a new depth and a subsequent 2D image was acquired. This procedure was repeated over a time period of 282 s to enable the construction of a 3D image cube at a single shelf temperature and thus product temperature setting. The temperature of the shelf was then adjusted to obtain a new product temperature and the process was repeated. The 3D image covered an area of approximately 0.75 mm in width, 4 mm in height, and 1.5 mm in depth (*x*/*y*/*z*). The reported instrument measurement resolution was 6.9 μm/7.5 μm lateral/axial. Additional details regarding the single vial freeze-dryer and the OCT optical imaging systems are described in Reference [12].

Measurement Results

Mujat et al. [12] have provided a detailed description of the OCT-FDM hardware while Greco et al. [11] described its use for determining pharmaceutical product formulation collapse temperature. Demonstration of the new measurement technique focused on comparing OCT-FDM collapse temperature determinations to LT-FDM determinations and DSC measurements of T_g'. The authors reported that in general the collapse temperatures of product formulations drying in vials determined using OCT-FDM were warmer than those determined using LT-FDM of thin-film samples. For example, 5 % sucrose formulations were investigated using both LT-FDM, T_c: −32 °C (Fig. 7), and OCT-FDM, T_c: −28 °C (Fig. 8), measurement tech-

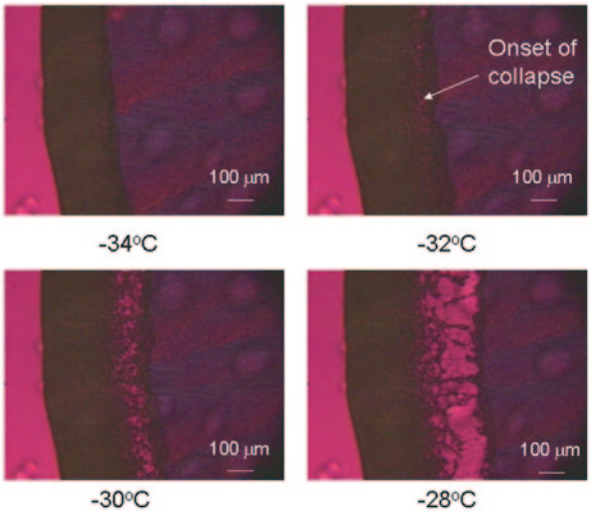

Fig. 7 Light transmission freeze-drying microscopy for a 5 % sucrose solution (Adapted from [11])