of the technique to instances where foam is present is questionable, results for FT-300 wax are in good agreement with values obtained using the photographic method, in the present study and those reported for paraffin waxes by Deckwer and coworkers.

D.4. Comparison of Techniques Used to Measure Bubble Size Distributions

Three different approaches were used to estimate the Sauter mean diameters of bubbles in the large columns (0.229 m ID and 0.24 m ID) and two techniques were used in the smaller column (0.051 m ID). Results from the various techniques are compared here. The discussion is limited to results from the larger columns since results are qualitatively similar for the two cases.

The dynamic gas disengagement (DGD) technique gives an average value of the Sauter mean bubble diameter for the entire column; whereas photographs near the column wall and center give only point estimates of the Sauter mean bubble diameter. Results from the DGD technique could be considered as the base case since this technique accounts for all bubbles unlike the photographic technique. Figure V-76 shows the variation of Sauter mean bubble diameter for FT-300 wax at 265°C in the large columns equipped with the 19 X 1.85 mm perforated plate distributor. Results obtained using DGD, photos at the wall (at a height of 1.96 m above the distributor), and photos obtained near the center of the column (at a height of 1.37 m above the distributor) are included in this figure. These results show that d_s values obtained from DGD measurements lie between those obtained from photographs near the center and near the wall of the column (for gas velocities greater than 0.04 m/s). This is as expected, since the DGD gives

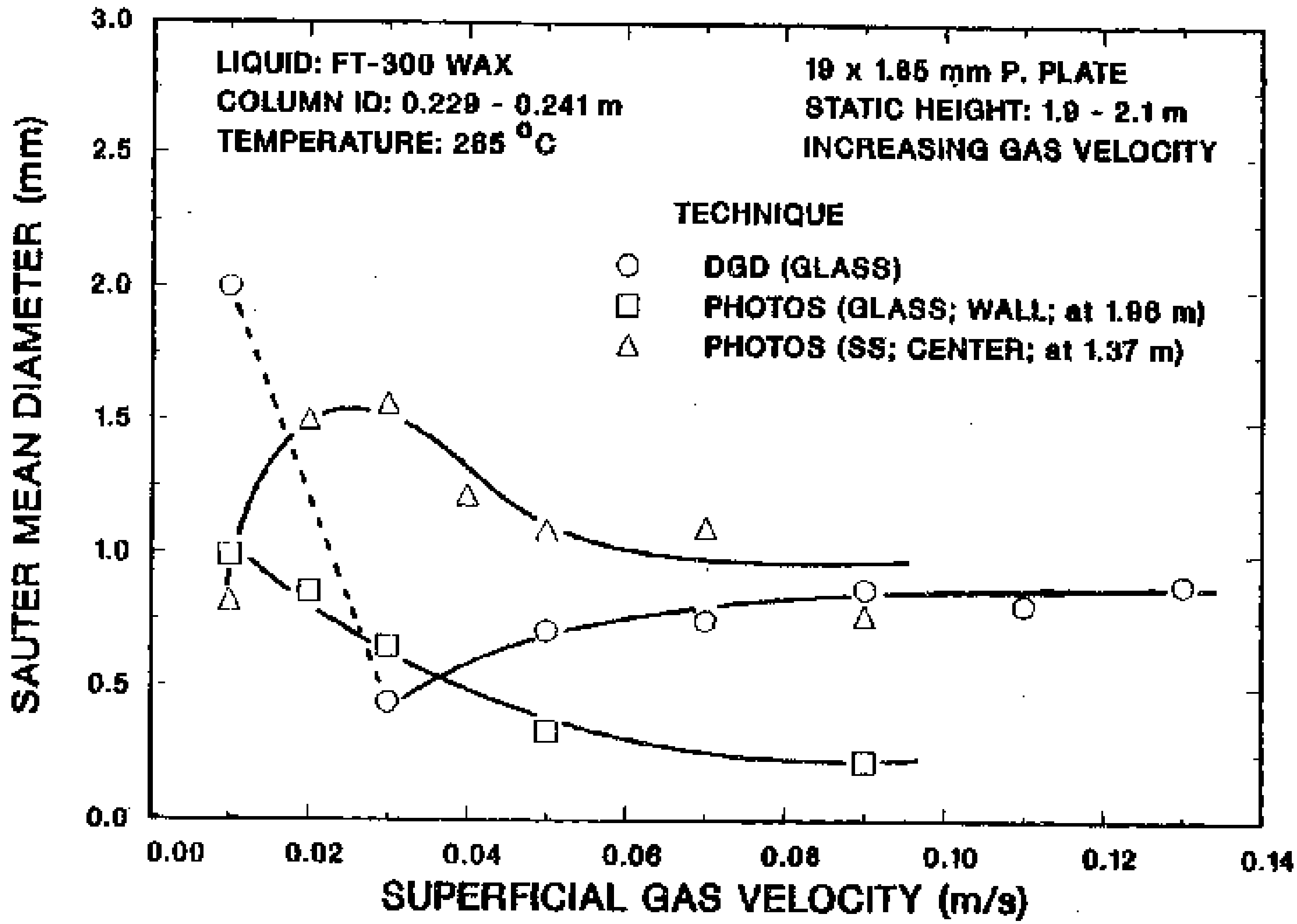

Figure V-76. Comparison of techniques used to determine the Sauter mean bubble diameter (○ - Run 1-3; □ - Run 2-3; △ - Run 2-7) an average Sauter mean diameter for the entire dispersion (i.e. it includes bubbles near the center and near the wall of the column). However, photographs taken near the wall of the column produced significantly lower Sauter mean bubble diameters. The d_s value from DGD at 0.03 m/s is significantly lower than that from photographs taken near the center of the column because foam was present at this range velocity. The DGD technique has serious limitations in the presence of foam and d_s for such conditions is dictated by the large number of bubbles in the foam, thus, lowering the Sauter mean bubble diameter. However, d_s in the presence of foam was found to be consistently around 0.5 mm using the DGD technique. A similar value for d_s was found when photographs of pure foam (with SMP distributor in the 0.051 m ID column) were analyzed.

Results from DGD and photography suggest that the Sauter mean diameter for FT-300 wax at 265°C is around 0.8 mm. The DGD technique showed that d_s increases significantly with a decrease in temperature. The photographic technique was not able to discern the effect of temperature on d_s in the 0.051 m ID column, while trends in the larger column were opposite than those obtained by DGD.

Figure V-77 compares the size of small bubbles obtained using DGD with bubble sizes obtained from photographic measurements near the wall for the 0.229 m ID column. The photographs were taken just after the gas flow to the column was shut off after a given velocity. Arithmetic average bubble diameters are used for values from photographic measurements. Figure V-77 shows that the two sets of diameters compare well except at 0.01 m/s.

The above discussion illustrates that the photographic technique can be used to estimate the interfacial area in bubble columns, if proper modifications are made and precautions taken in order to counter its limitations.

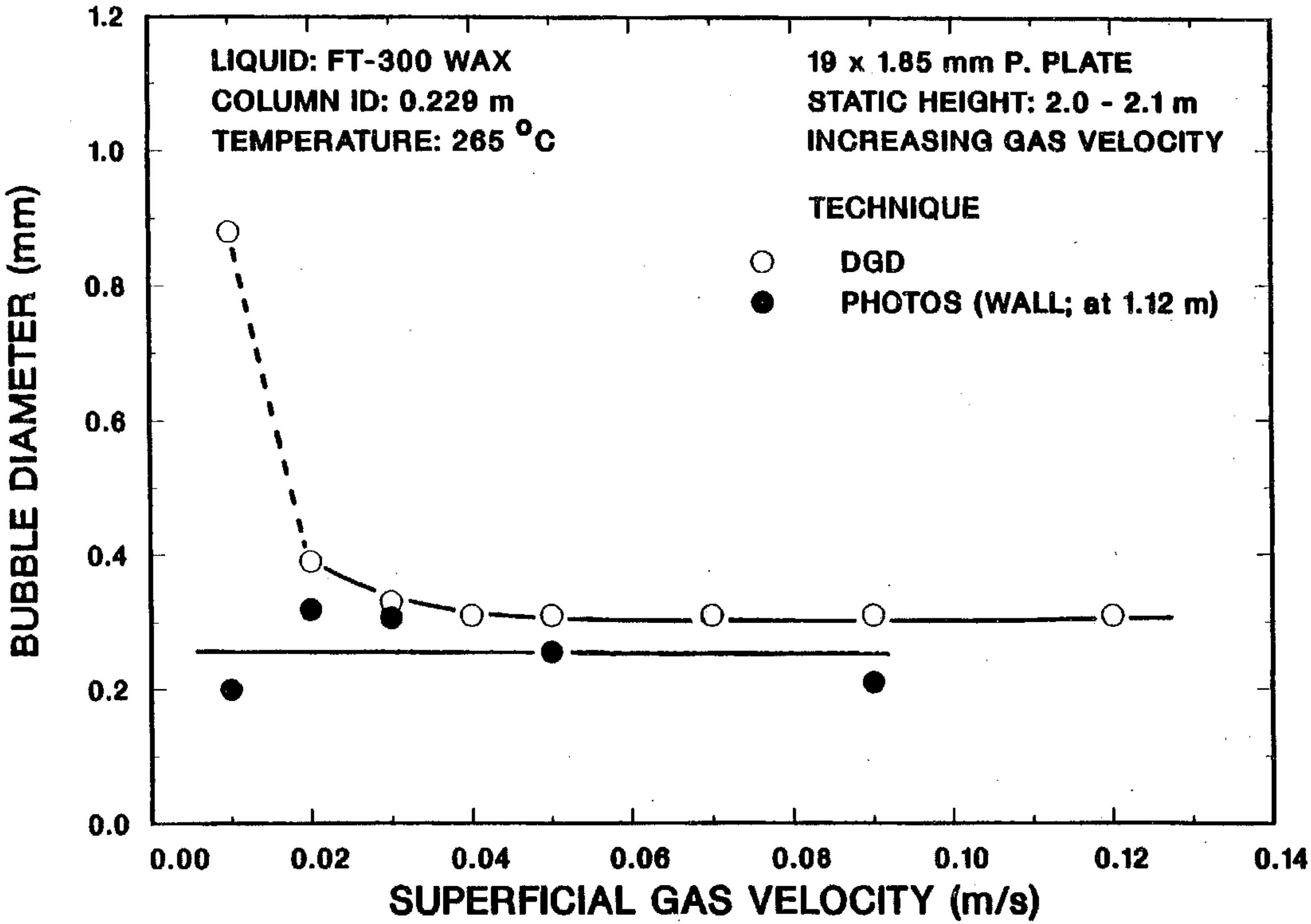

Figure V-77. Comparison of small bubble diameters estimated from DGD and photographic techniques (○- Run 2-8; ●- Run 2-3)