In the present work we have studied the use of Glow Discharge Optical Emission Spectroscopy as an analytical tool for thin film characterization. The elemental composition depth profiles measured by GD-OES are comparable to those obtained by other thin film characterization techniques. The reproducibility determined on GD-OES reference samples is comparable to the analytical results provided by XPS, which is widely used for thin film characterization. The measured composition depth profiles provide important information on the deposited layer. The simplicity of the method allows us to measure large number of specimen produced under different plasma deposition conditions. These analytical results, when carefully interpreted and compared to the deposition conditions allow us to improve the selection of optimal conditions. Only at a later stage a full quantification of the elemental depth profiles will be necessary, to validate the chemical composition of the LiPON layers.