been set at 40V, because it results in the largest pore size and the highest pore density without losing the regularity of the structure and to obtain the best quality of AAO template.[22] In order to know the effect of temperature on the pore size the temperature is kept constant during anodization of each AAO. It was noticed that the anodizing current increased with the temperature. When we increase the temperature ,the pore diameter of the pores increase by using the two-step anodization process. During the anodization, temperature should be kept lower than room temperature to prevent the formed oxide structure from being dissolved in acidic electrolytes. A second reason to keep the temperature as low as possible is to avoid a local heating at the bottom of the pores during the course of anodization (specially, in the case of anodization at a high potential). The local heat causes an inhomogeneous electric field distribution at the bottom, leading to local electrical breakdown of the oxide . In fact, cracks and bursts of the oxide film are generated if porous alumina is formed without temperature controlling. If the temperature is too low (just below zero degree) and diluted electrolytes are used, the electrolyte may freeze. In addition, the speed of the growth of porous alumina is affected by the temperature. The lower the temperature, the lower is the growth rate.

However, in all the cases the anodization temperature is purposely kept low, preferably below the room temperature because, high bath temperature enhances the dissolution of porous oxide film in the electrolyte. The heat generation is harmful to nanostructures because it accumulates randomly all over the AAO structure especially the discontinuous geometry to enhance the dissolution effect. [23] It was found that a long anodization time can improve the regularity of the cell arrangement. Defect free regions appear in large domains whereas defects are found at the boundaries of these domains. That means the size of the defect free region increases with the anodization time. Even at the deficiency site of the concave pores configuration can be recovered after a long anodization period. This is because the pores at deficient sites tend to develop and recover the closed packing arrangement of the cylindrical cells, which is the most probable arrangement in the cell configuration and leads to the thicker of AAO template.[24,25]

4. Conclusion

AAO templates were produced under various conditions of electrolyte temperatures and anodizing voltages. The vertical growth rate of pores was found to vary exponentially with anodizing voltage in comparison with linear variation with respect to the electrolyte temperature. It is found that through variation voltage and temperature , we conclude that the best result was achieved at 40 V and 10 $^{\circ}$C to obtain highly ordered hexagonal nanopores of AAO template. The AAO templates with different pore diameters and thicknesses were successfully fabricated for the growth of nano dimensional materials using both wet ,dry deposition techniques and PL sensing devices.

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