Synthesis and Characterization of ZnO quantum dots byelectrochemical method.

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Abstract:

Electrochemical method is used to synthesize nanosize ZnO particles. In this method, ZnO nanoparticles were prepared by using Acetonitril (CH_3CN) and Tetra hydrofuran at 4:1 proportion in which TOAB added as Capant. Experimental is performed at two temperatures i.e. at room temperature& 0 degree Celsius. UV spectroscopy techniques used for characterization.

Key word: ZnO nanoparticles, electrochemical method, UV spectroscopy.

INTRODUCTION

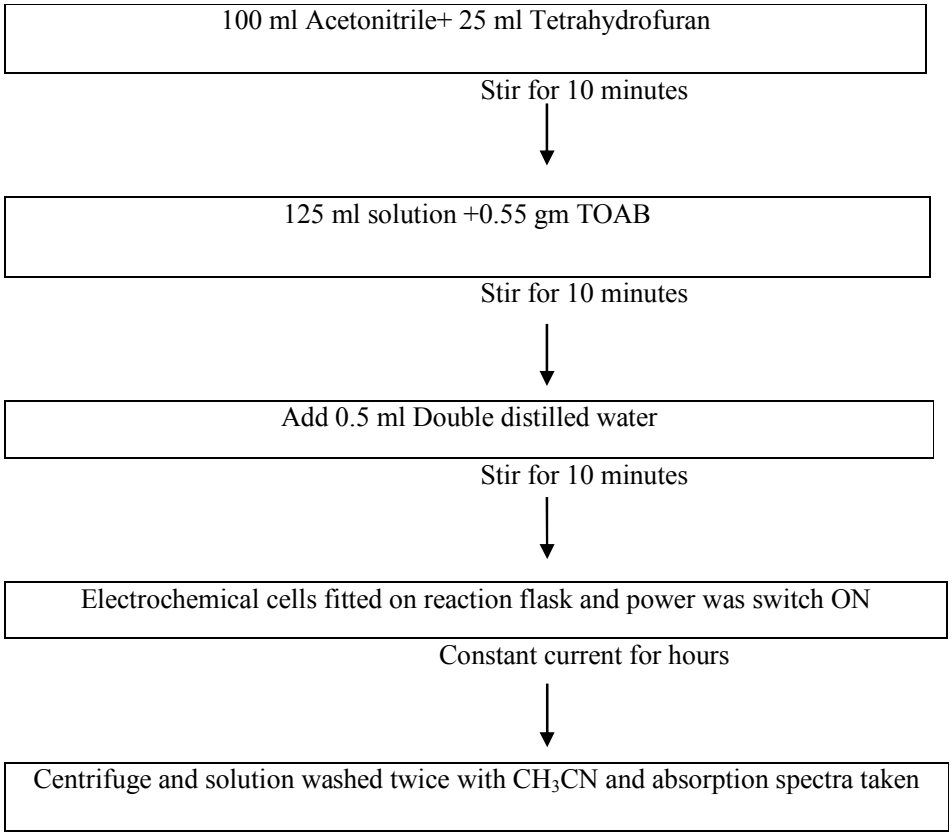
ZnO nanoparticles find tremendous use in all aspect in different application as medical, sensor, cosmetic etc. Synthesis of ZnO was carried out at room temperature and 0 degree Celsius temperature.This technique is having a wide scope for utilization of chemicals with minimum wastage. Hence, has large potential for production of quantum dots on large scale.

Experimental Details

Electrochemical method is an inexpensive one involving two electrode (zinc and platinum). Electrochemical cell which is devised along with anode. The anode is in form of bulk metal sheet to be transformed into corresponding metal ions first and then into corresponding oxide. Platinum in the form of a foil secured cathode. The distance between the electrolytes is kept fixed. An electrolyte to be analyzed is first freshly distilled (1).The electrolysis is carried out at room temperature under oxygen atmosphere for few hours in constant current mode. The quantum dots obtained were analyzed by using UV-VIS absorption spectra. The acetonitril and THF are taken in proportion 4:1. (2) Then, in flask both chemicals are taken and two electrodes are dipping i.e. zinc as anode and platinum as cathode. Current is set up in between two electrodes through electrolytes. The path becomes resistive.The power supply acts in constant current mode. The properties of nanoparticle formed are depending on many parameters like current, capping agent, time, ratio of chemicals etc.

In this process, TOAB i.e. TetraOctylAmmoniumBromide is used as “Cappant” and function of cappent is layering which prevents contamination of ZnO particles (3). The layer which arrest the growth of particle is called capping and material which done this work is called “capping agent”. (4) The amount of cappant also affects properties of material. TOAB acts as cappent also provide conductivity to solution.

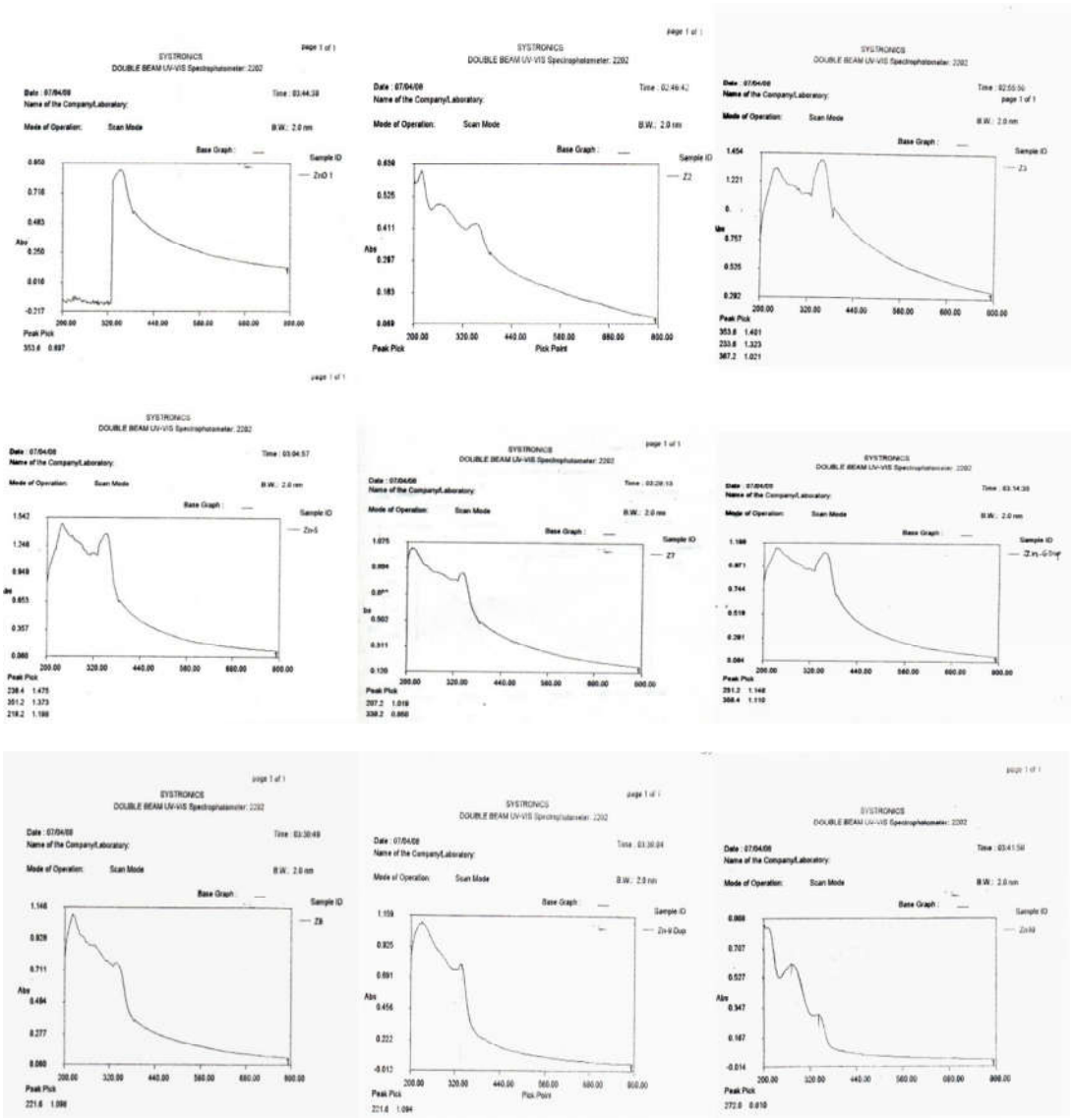
Synthesis Procedure:



Observation

Sr No	Current	Duration	Temperature	UV peak	Eg (eV)
Z1	10 mA	3 hour	32.4°C	353.6	3.56
Z2	10 mA	4 hour	31.3°C	348.8	3.55
Z3	20 mA	3 hour	32°C	353.6	3.50
Z4	3 mA	3 hour	31°C	No Result	
Z5	4.1 mA	5 hour	32°C	351.2	3.53
Z6	20 mA	4 hour	27°C	356	3.48
Z7	10 mA	3 hour	0.4°C	339.2	3.65
Z8	15 mA	2 hour	0°C	336.8	3.68
Z9	15 mA	2 hour	28°C	344.0	3.60
Z10	15 mA	2 hour	30.2°C	272.0	4.55

UV-Visible Spectroscopy



Result:

Band gap energy of bulk zno material is 3.37 eV. In case of ZnO nanoparticles, we have prepared and we observe a Blue Shift. The absorption edge appeared at 339.47 nm (3.65 eV).

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