JOURNAL OF CRITICAL REVIEWS

ISSN- 2394-5125 VOL 7, ISSUE 15, 2020

OPTICAL PROPERTIES OF ZINC NANOPARTICLE PREPARED BY LASER ABLATION IN LIQUID TECHNIQUE

Abbas M. Ali Al-Kifaie Narimann Neamah[1]

[1]Department of Physics, Faculty of Science, University of Kufa, Iraq. E-mail: abbasm.alkifaie@uokufa.edu.iq

Received: 22.04.2020 Revised: 23.05.2020 Accepted: 20.06.2020

ABSTRACT: In this research the effect of Laser energy n the optical properties and particle size of colloidal zinc nanoparticles prepared by pulsed laser ablation in liquid technique (PLAL). Various Laser energies (800 and 900) mJ of (Nd: YaG) pulsed laser were used to prepared colloidal zinc nanoparticles with size around 9-62(nm) which measured by using particle size analyser. The absorbance spectra and the surface plasmon resonance was measured to study the optical properties of the prepared Zn NPs. The results showed the possibility of preparation of colloidal solutions of zinc with particle size less than 10 (nm) was very high. The results showed that the surface Plasmon resonance and the high optical density was found at the wavelength 255 for laser energy of 800 mJ and shifted to lower wavelength (blue shift) 247 (nm) with higher optical density at laser energy 900 mJ which gives an indicate that the increase of laser energy leads to increase of the nanoparticles density and number.

KEYWORDS: Pulsed laser ablation, Zinc nanoparticles, Colloidal nanoparticles , Optical absorbance, Laser particles size distributions.

 DOI: http://dx.doi.org/10.31838/jcr.07.14.197

I. INTRODUCTION

In last years, nanomaterials took abroad area and importance of research and development activity. Nano materials are of interestingly because at this scale uniquely optical, magnetic, electrical and other properties. These properties have the potential for nice impacts in electronics, medicine, space exploration and other fields [1, 2].

Nanomaterials might be defined as a group of materials (crystalline or amorphous) of organic or inorganic materials have sizes within the range of 1-100 nm. Nano materials are classified into nanostructured materials and nano phase, nanoparticle materials [3,4]. Zinc nanoparticles are highly oxidative as compared to silver and gold, therefore, synthesis of those particles within the aqueous media is preferred. Recently, pulsed laser ablation in aqueous media has provided a replacement technique for synthesis of size controlled metallic nanoparticles [5]. The laser ablation method can prepare the materials during a very clean environment like deionized and efficiently controlled water, which results in the assembly of highly pure nanomaterials.

The properties of nanoparticles like their size and shape are often controlled by laser pulse parameters like wavelength, pulse duration, laser energy and also the liquid medium [6]. Because of the accommodation of optical and magnetic properties, nanoparticles have attracted great attention on the granularity of the metal within the nanoscale [7].

In this research the effect of the pulsed Laser energy on the optical properties and particle size of zinc nanoparticle were investigated.

II. EXPERIMENTAL DETAILS

A metal plate of Zinc with high purity. supplied from (The British Drug Houses ltd labortory Chemical Group) with purity (99.88%)). The Zn plate had a smooth surface and were first cleaned ultrasonically in acetone and distilled water baths consecutively then rinsed with water for 15min before the experiment to remove all contaminants. Znic colloidal nanoparticles were prepared by pulse Laser ablation in liquid (PLAL) technique using Q-switched Nd:YAG laser. The focused energy was (800 and 900) mJ, the laser wave length is 1064 nm and the

ISSN- 2394-5125 VOL 7, ISSUE 15, 2020

number of applied pulses 150 pulses, figure (1) illustrate the schematic diagram of ablated nanoparticles by PLAL technique . The target of high purity (Zinc) plate was placed on the bottom of open pyrex container containing 2ml of ultrapure deionized water and therefore the distance between the target and laser source is 12 cm at room temperature.

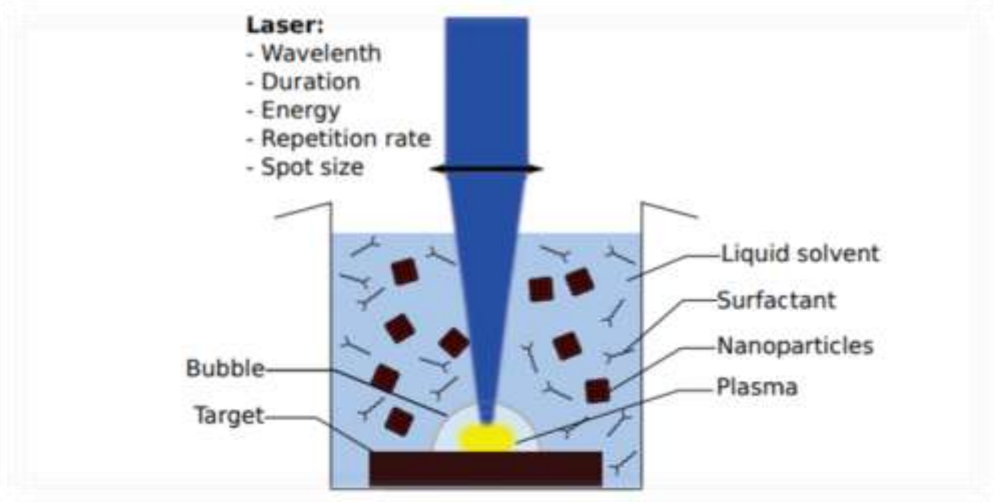

Fig. 1: Schematic Diagram of Laser Ablation System

Plasmon absorption spectrum was recorded using the range of UV-Vis (200-800) nm regions of the electromagnetic waves using Mega 2100 UV-Vis spectrophotometer by Sinco Co. and particle size distribution was estimated by using the Particle size analyzers (ABT-9000NANO) (Angstrom Advanced Inc)

III.RESULTS AND DISCUSSION

Figure 2 show UV-visible plasmon spectrum of zinc nanoparticles produced by laser ablation in deionized water.

1. Optical absorbance (SPR band)

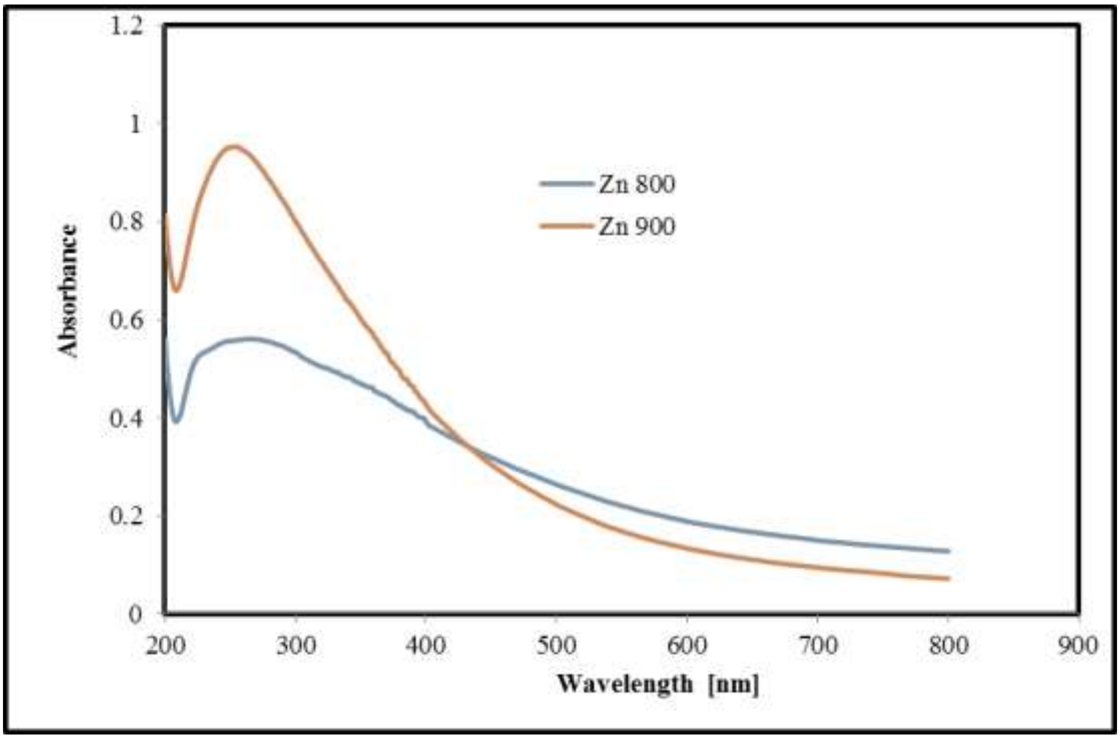

Fig. 2: Optical Absorbance Spectra of (Zn Nps in energy 800mJ and 900 mJ)

Zinc (Zn) nanoparticle was synthesized by the pulsed laser ablation at room temperature. it's noted that the absorbance spectra and therefore the fundamental absorption edge of Zn are shifted towards the short wavelength compared with (S C SINGH and et.al 2007). Where the optical phenomenon (SPR band) of Zn has been reported in 800mJ high absorbance in 255nm. In 900mJ high absorbance in 247nm decrease wavelength increase in energy increase in absorbance. it's clear that the absorption edge shifts toward the lower wavelength with increasing in size of the nanoparticle.

2. Laser particles size distributions

The result revealed that the average diameters of nanoparticles change with an change in energy .As show table 1.

Table 1: The Particles Size Distributions of Zinc

Metal Nanoparticles	Energy[mJ]	Pulses number	Diameter[nm]	Differential distribution %
Zn	800	150	8.89-9.97	100
Zn	900	150	56.1-62.9	100

We reported increase in particle size with increase in energy .As show figure 3 and 4.

ISSN- 2394-5125 VOL 7, ISSUE 15, 2020

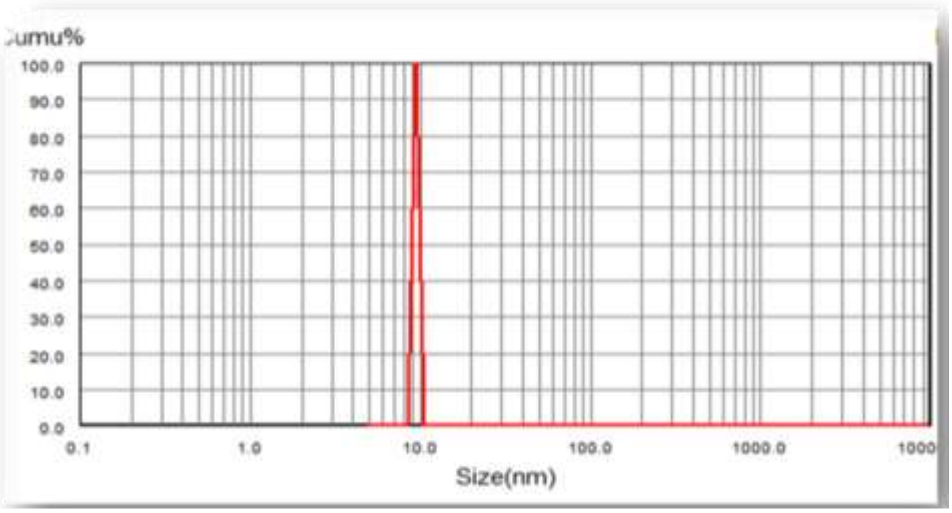

Fig. 3: The Particles Size Distributions to Zn in 800mJ

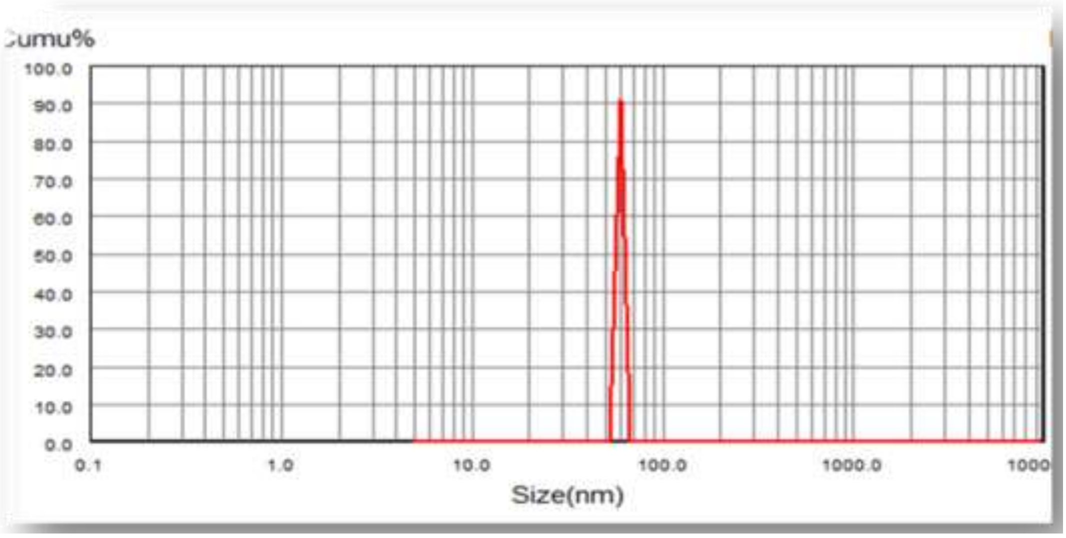

Fig. 4: The Particles Size Distributions to Zn in 900mJ

IV. CONCLUSIONS

The laser ablation of zinc plate within the solution of deionized water employed to organize size and shape controlled nanoparticles. Laser scraping of the Zinc metal showed the best efficiency at energy 800mJ. The possibility of preparation of colloidal solutions of zinc and grain size less than 10 (nm).

V. ACKNOWLEDGMENTS

First of all praise be thanks to Allah, the almighty God, the most gracious and the most merciful, who provided me with capability to complete this research work. I would like to express my gratitude and appreciation to the all staff in the Department of Physics, Faculty of Science, University of Kufa.

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