LEMBAR
HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : JURNAL ILMIAH

Judul Karya Ilmiah (Artikel)	:	The role of metastable atoms in atomic excitation process of magnesium in microwave-assisted laser plasma
Jumlah Penulis	:	4 Orang
Status Pengusul	:	Penulis pertama/ ~~Penulis ke~~ / Penulis Korespondesi **
Identitas Jurnal Ilmiah	:	a. Nama Jurnal : Optics Communications b. Nomor ISSN : 0030-4018 c. Volume, Nomor, Bulan, Tahun : Vol 479, No.-, Januari 2021 d. Penerbit : Elsevier e. DOI artikel (jika ada) : 10.1016/j.optcom.2020.126457 f. Alamat web jurnal : https://www.sciencedirect.com/science/article/pii/S0030401820308750?via%3Dihub g. Terindeks di Scimagojr/Scopus ~~atau di….**~~
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Semarang, 5 Maret 2021

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Prof. Dr. Suryono, S.Si., M.Si.

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Bidang ilmu/Unit kerja : Fakultas Sains dan Matematika/Fisika

Reviewer 2

Dr. Eng. Eko Hidayanto, S.Si., M.Si.
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Bidang ilmu/Unit kerja : Fakultas Sains dan Matematika/Fisika

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		d.	Penerbit	: Elsevier
		e.	DOI artikel (jika ada)	: 10.1016/j.optcom.2020.126457
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b. Ruang lingkup dan kedalaman pembahasan (30%)	12			11,8
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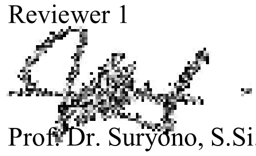

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a. Kelengkapan unsur isi jurnal (10%)	4			3,8
b. Ruang lingkup dan kedalaman pembahasan (30%)	12			11,7
c. Kecukupan dan kemutahiran data/informasi dan metodologi (30%)	12			11,6
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	12			11,5
Total = (100%)	**40**			**38,6**
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2. **<u>Ruang lingkup dan kedalaman pembahasan:</u>**
   Paper ini membahas tentang proses eksitasi atom magnesium telah dilakukan dalam plasma laser gelombang mikro, dengan pembahasan yang baik bahwa intensitas emisi dari garis magnesium ionik memiliki energi eksitasi relatif rendah sekitar 4 eV.
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Document type
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00304018

DOI
10.1016/j.optcom.2020.126457

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The role of metastable atoms in atomic excitation process of magnesium in microwave-assisted laser plasma

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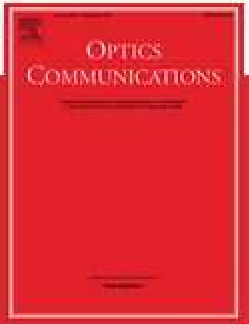

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Interferometric imaging for the tomography of rough particles in a flow: A case study

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ARTICLE INFO

Keywords:
Interferometric particle imaging
Speckle
Rough particles
Tomography

ABSTRACT

The possibility to perform the tomography of irregularly-shaped rough particles in a flow using multi-view interferometric imaging is investigated. Combining three perpendicular angles of views, we reconstruct a family of possible 3D-shapes from speckle patterns. The estimation of an error parameter enables the elimination of erroneous 3D-shapes to obtain a more accurate estimation of the particle's volume. The principle is tested and confirmed experimentally by analyzing a set of three interferometric images of "programmable" particles generated by a digital micromirror device.

1. Introduction

The tomography of irregularly-shaped particles in a flow is particularly interesting for meteorology, combustion, nuclear safety and any domain concerned. In many cases, a single-shot technique is necessary because the speed of particles can be very important, and instruments should tend ideally to a real-time analysis. A configuration as the CT-scan (computed tomography scan) in medicine where the object is fixed while the X-ray tube rotates around the object is not applicable. In a similar way, other methods as confocal microscopy, electron, or optical tomographic microscopy require fixing, trapping or confining particles [1–5]. In airborne operation or in icing wind tunnels for example, the relative speed of particles as ice crystals or ashes due to the plane's flight can exceed 200 m s^{-1}. A setup where the particle is illuminated by a unique short flash, while different sensors acquire simultaneously the signal delivered by the particle in different directions, must be envisaged. Light scattering techniques are good candidates because they can answer these requirements, and first set-ups have been developed, using digital holography for example [6].

In this family of techniques based on light scattering properties, interferometric particle imaging appears as another interesting candidate [7]. When illuminated by a laser pulse, rough particles generate interferometric images that are speckle patterns. They can be linked quantitatively in size and shape with the initial shape of the particle [8–14]. Dual-view set-ups have been tested to make simple 3D-particle's shape recognition, or to estimate the volume of ice particles in a flow [7,9,12]. But set-ups proposing three perpendicular angles of view to give a more-complete description of the particle have not been done yet. One difficulty arises from the analysis of the interferometric images of the particles. After 2D-Fourier transformation, these images give the 2D-autocorrelation of the contour of the particle projected in the plane of the CCD sensor (corresponding to this angle of view). As the 2D-autocorrelation of a 2D-shape is not the 2D-shape itself, the reconstruction procedure combining different views can be particularly complex. It is the aim of this study to realize a case study in order to understand the difficulties that can appear from the combination of three views from three perpendicular angles of view.

Section 2 will describe the principle of the case study carried out in this article. Section 3 will then describe the experimental set-up used to record the interferometric images of "programmable" rough particles. It uses a Digital Micromirror Device (DMD) [15,16]. The interferometric images of a "programmable" particle, observed from three perpendicular angles of view, will be presented and analyzed. Section 4 will propose 2D-reconstructions of the three faces of the particle, while 3D-reconstructions combining the three perpendicular angles of view will be realized in Section 5. This section will show how a reconstruction's error parameter can be defined, how it can be used to refine the particle's shape reconstruction and to reduce the uncertainty about the particle's volume combining the three views. Section 6 will investigate the possibility to generalize the conclusions to other cases.

2. Principle of the case study

Interferometric Particle Imaging (IPI) enables rough particle sizing. First developed to measure the size of spherical droplets or bubbles, it could be extended to the analysis of irregularly-shaped rough particles. Let us consider an irregular rough particle under coherent laser

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https://doi.org/10.1016/j.optcom.2020.126412
Received 24 June 2020; Received in revised form 14 August 2020; Accepted 29 August 2020
Available online 1 September 2020

Optics Communications 479 (2021) 126413

Contents lists available at ScienceDirect

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journal homepage: www.elsevier.com/locate/optcom

Black metal nanoparticles from abrasion processes in everyday life: Bicycle drivetrains and rock-climbing ropes

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ARTICLE INFO

Keywords:
Metallic nanoparticles
Single scattering albedo
Appearance

ABSTRACT

Black objects are sometimes associated with black carbon, while shiny, highly reflecting surfaces are typically associated with metals. Here, we discuss several objects in everyday life that upon use take on a black color that is unlikely to be due to black carbon. We propose that this black color is caused by the formation of metallic nanoparticles from abrasion processes. We support this hypothesis using Mie theory and the fact that spherical metal particles are only shiny or bright if the imaginary part of their refractive index and its product with the particle size-parameter are both larger than three. While this is commonly true for bulk metals, the second condition is generally not fulfilled for metallic nanoparticles, and hence, such particles become highly absorbing, i.e., black. For the black grime accumulated on bicycle drivetrains and climbing ropes, we detected metal nanoparticles with electron microscopy, which likely originated from mechanical abrasion processes during use.

1. Introduction

In terms of visual appearance under white-light illumination, the whiteness of a particle is usually quantified by the single scattering albedo (SSA), which is the ratio of the scattering cross section C_{sca} and extinction cross section C_{ext} [1],

$$\mathrm{SSA} = \frac{C_{sca}}{C_{ext}} = 1 - \frac{C_{abs}}{C_{ext}}. \quad (1)$$

In Eq. (1), C_{ext} is the sum of C_{sca} and the absorption cross section C_{abs} for a given wavelength λ of incident light. Due to the conservation of energy, the SSA is bounded as $0 < \mathrm{SSA} \leq 1$. When the SSA = 1 across the visible wavelength range the appearance of a particle is described by terms like "white", "shiny", "bright", or "reflective", because all extinction is caused by scattering. If the SSA equals zero across the visible wavelength range, the term "black" is appropriate since the extinction is exclusively due to absorption. Values for the SSA between zero and one indicate an appearance in different shades of "gray", or possibly a colored appearance if the material exhibits a significant variation of its refractive index and SSA as function of wavelength. The term "white" used below will denote a particle exhibiting $0.7 < \mathrm{SSA} \leq 1$, "gray" for $0.2 < \mathrm{SSA} \leq 0.7$, and "black" for $\mathrm{SSA} \leq 0.2$. Because of its connection to energy conservation, the SSA is also an important quantity in energy-budget considerations of physical systems involving light scattering from particles. For example, the SSA is the dominant intensive property for aerosol-particle radiative forcing in the atmosphere [2–4].

In the following, we consider two common objects encountered in everyday life, a bicycle drivetrain and a rock-climbing rope, where grime is produced through use that eventually takes on a black appearance. We propose that the black appearance originates from black metallic nanoparticles that accumulate in the grime due to mechanical abrasion and support this hypothesis with Mie theory and electron microscopy of the grime material. For simplicity, we focus our theoretical considerations on homogeneous spherical particles, hence the use of Mie theory [5].

The appearance, i.e., SSA here, of metallic nanoparticles is completely described in Mie theory by the particle's complex-valued refractive index $m = n + i\kappa$, where n and κ are the real and imaginary parts of m, respectively, and the size parameter $x = \pi D/\lambda$, where D is the particle diameter. Moreover, "Mie theory, limited though it may be, does provide a first-order description of optical effects in nonspherical particles, and it correctly describes many small-particle effects that are not intuitively obvious" [6]. While we use Mie theory to gain basic understanding of SSA, this approach is limited because the metallic particles considered here are not spherical and homogeneous as required by Mie theory and their number density is not sufficiently small for rigorous application of the single scattering concept [6]. We build upon existing discussions for the SSA in the small and large

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https://doi.org/10.1016/j.optcom.2020.126413
Received 24 June 2020; Received in revised form 16 August 2020; Accepted 29 August 2020
Available online 1 September 2020