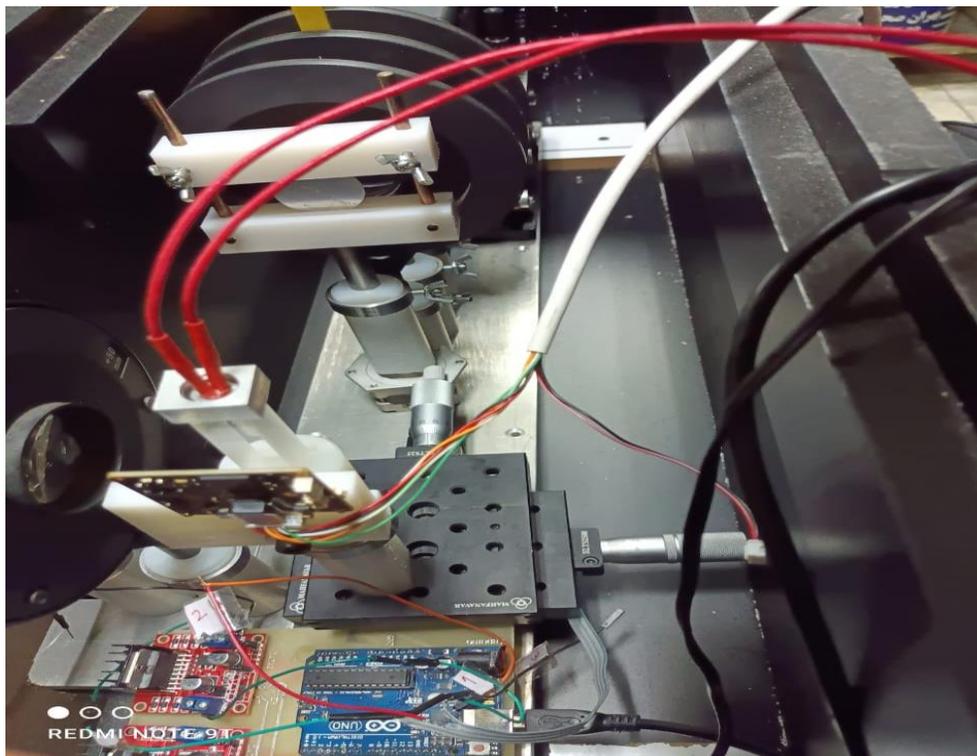


## ساخت دستگاه اندازه‌گیری ضریب انتقال حرارت سیالات



دستگاه اندازه‌گیری ضریب انتقال حرارت سیالات با استفاده از روش جابجایی باریکه نور و تعیین توزیع اندازه ذرات با استفاده از روش تفرق دینامیکی نور (DLS) توسط جناب آقای مهندس سروش جوادی پور دانش آموخته مقطع کارشناسی ارشد دانشکده مهندسی و علم مواد دانشگاه صنعتی خواجه نصیرالدین طوسی با همکاری محققانی از دانشگاه علوم تحقیقات تهران، دانشگاه علم و صنعت، دانشگاه شهید بهشتی، پژوهشگاه نیرو و پژوهشگاه صنعت نفت، به سرپرستی استاد فقید جناب آقای دکتر علی شکوه فر ساخته شد.

در این پژوهش با استفاده از روش جابجایی باریکه و محاسبه انحراف نور ناشی از شوک حرارتی با استفاده از پردازش تصویر، ضریب هدایت حرارتی نانوسیال  $Al_{12}Mg_{17}$  تعیین شد. همچنین با استفاده از روش تفرق دینامیکی نور و پردازش سیگنال، توزیع اندازه ذرات نانوسیال  $Al_{12}Mg_{17}$  تعیین گردید. لازم به ذکر است که نتایج حاصل از این پژوهش در مجله Scientific Report به چاپ رسیده است.

<https://www.nature.com/articles/s41598-023-40844-9>



## OPEN Stability, optimum ultrasonication, and thermal and electrical conductivity estimation in low concentrations of $Al_{12}Mg_{17}$ nanofluid by dynamic light scattering and beam displacement method

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The thermal conductivity and stability of nanofluids pose challenges for their use as coolants in thermal applications. The present study investigates the heat transfer coefficient (HTC) of an  $Al_{12}Mg_{17}$  nanofluid through the utilization of a novel beam displacement method. The study also examines the nanofluid's stability, particle size distribution (PSD), TEM micrograph, and electrical conductivity. From three distinct categories of surfactants, a particular surfactant (CTAB) was chosen to disperse  $Al_{12}Mg_{17}$  nanoparticles in DI water, and subsequently, a two-step method was employed to generate the nanofluid. Dispersion stability is visually monitored and quantified with a zeta potential test. HTC and PSD are measured using optical setups. To evaluate the results, the HTC obtained from the beam displacement method is compared with that of the KD2 Pro apparatus, and the PSD findings are analyzed through TEM micrographs. The results show that a 0.16 vol.% CTAB is the maximum stability for 0.025 vol.%  $Al_{12}Mg_{17}$  nanofluid properly. The optimum ultrasonication period is 2 h, yielding a peak PSD of 154 nm. Increasing nanoparticle concentration enhances HTC up to 40% compared to the base fluid at 0.05 vol.%. Electrical conductivity increases linearly from 155 to 188  $\mu S/cm$  with nanoparticle concentration. Optical methods for measuring HTC in nanofluids offer the advantage of early results, prior to bulk motion. Thus, the application of nanofluids in thermal systems necessitates the development of optical techniques to improve accuracy.

A nanofluid is a heterogeneous mixture of a base fluid and nanoparticles which can be utilized in a broad range of thermal applications in both industry<sup>1</sup> and medicine<sup>2</sup>, including but not limited to solar collectors<sup>3</sup>, vehicle radiators<sup>4</sup>, and electronic cooling<sup>5</sup>. Due to their substantial role in transferring heat, nanofluids can bring efficiency to the system performance, which makes them fascinating area of study for engineers. The differences in thermal conductivity among nanofluids have already been studied<sup>6</sup>. However, it is imperative

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