

Accepted Manuscript

Research paper

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PII: S0009-2614(17)30500-6

DOI: <http://dx.doi.org/10.1016/j.cplett.2017.05.054>

Reference: CPLETT 34843

To appear in: *Chemical Physics Letters*

Received Date: 20 April 2017

Revised Date: 19 May 2017

Accepted Date: 21 May 2017

Please cite this article as: N. Priyadarshani, T.C. Sabari Girisun, S. VenugopalRao, Ultrafast Nonlinear Optical Studies of Equiaxed CuNbO_3 Microstructures, *Chemical Physics Letters* (2017), doi: <http://dx.doi.org/10.1016/j.cplett.2017.05.054>

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Ultrafast Nonlinear Optical Studies of Equiaxed CuNbO₃ Microstructures

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Abstract

Diverse microstructures of monoclinic copper niobate (m-CuNbO₃) were synthesized by solid-state reaction (900 °C, 3-12 hours). FESEM data demonstrated that agglomerated clusters grew as elongated grains which migrated to form web-shaped equiaxed structure and dissected to form individual equiaxed microstructure. With femtosecond laser excitation (800 nm, 150 fs), open aperture data Z-scan revealed the presence of two-photon absorption. The nonlinear refractive index (n_2) toggled between positive and negative nonlinearity for different microstructures. Web-shaped equiaxed structure kindled both the nonlinear absorption ($\beta_{\text{eff}}=2.0 \times 10^{-12}$ m/W), nonlinear refraction ($n_2=3.16 \times 10^{-17}$ m²/W) and a strong optical limiting action (onset limiting threshold of 22.24 $\mu\text{J}/\text{cm}^2$).

Keywords: Copper niobate; Morphological studies; femtosecond; Z-scan; optical limiting

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