

**ANALISIS PENGARUH LAPISAN rGO PADA  $\text{LaFeO}_3$  YANG DI-*DOPING*  
Gd SEBAGAI MATERIAL SENSOR GAS ETANOL MENGGUNAKAN  
*DENSITY FUNCTIONAL THEORY***

**SKRIPSI**

diajukan untuk memenuhi salah satu syarat untuk memperoleh gelar Sarjana Sains  
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Oleh

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ANALISIS PENGARUH LAPISAN rGO PADA LaFeO<sub>3</sub> YANG DI-DOPING  
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## PERNYATAAN

Dengan ini saya menyatakan bahwa skripsi dengan judul “ANALISIS PENGARUH LAPISAN rGO PADA  $\text{LaFeO}_3$  YANG DI-DOPING Gd SEBAGAI MATERIAL SENSOR GAS ETANOL MENGGUNAKAN *DENSITY FUNCTIONAL THEORY*” ini beserta seluruh isinya adalah benar-benar karya saya sendiri. Saya tidak melakukan penjiplakan atau pengutipan dengan cara-cara yang tidak sesuai dengan etika ilmu yang berlaku dalam masyarakat keilmuan. Atas pernyataan ini, saya siap menanggung resiko/sanksi apabila di kemudian hari ditemukan adanya pelanggaran etika keilmuan atau ada klaim dari pihak lain terhadap keaslian karya saya ini.

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## KATA PENGANTAR

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Skripsi ini telah disusun sebagai syarat untuk memperoleh gelar Sarjana Sains, Departemen Pendidikan Fisika, Program Studi Fisika. Penulis menyadari bahwa skripsi ini masih memiliki kekurangan dan jauh dari kata sempurna. Oleh karena itu, kritik dan saran yang membangun akan sangat ditunggu oleh penulis. Semoga skripsi ini dapat memberikan manfaat dan tambahan pengetahuan bagi pembacanya. Akhir kata, penulis mengucapkan terima kasih.

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## ABSTRAK

LaFeO<sub>3</sub> (LFO) banyak digunakan sebagai material penyusun sensor gas dengan mekanisme adsorpsi oksigen. Namun, material LFO dalam aplikasi sensor gas etanol belum memiliki sensitivitas, selektivitas, dan temperatur kerja yang optimum. *Doping* Gadolinium (Gd) banyak digunakan dalam aplikasi sensor gas untuk meningkatkan sensitivitas sensor gas. Selain itu, material *reduce graphene oxide* (rGO) banyak digunakan dalam aplikasi sensor gas untuk meningkatkan selektivitas dan temperatur kerja sensor gas. Pada penelitian ini dianalisis pengaruh *doping* Gd dan penambahan lapisan rGO pada material LFO terhadap sensitivitas dan selektivitas berdasarkan energi adsorpsi sistem dengan molekul gas etanol menggunakan *Density Functional Theory* (DFT). Berdasarkan penelitian ini, diperoleh bahwa adanya *doping* Gd dan lapisan *single layer* rGO dapat meningkatkan energi adsorpsi. Penambahan lapisan rGO menunjukkan memberikan eskalasi energi adsorpsi sekitar 9.45%, dari -2.49 eV pada LFO yang di-*doping* Gd menjadi -2.75 eV ketika diberi lapisan rGO. Hal tersebut menunjukkan potensi material LFO yang di-*doping* Gd dan diberi lapisan rGO sebagai material sensor gas etanol.

**Kata kunci:** LaFeO<sub>3</sub>, Gadolinium, *reduce graphene oxide*, *density functional theory*, sensor gas, gas etanol

## ABSTRACT

LaFeO<sub>3</sub> (LFO) is commonly used as a material for gas sensor applications. However, the LFO material in ethanol gas sensor applications can still improve sensitivity, selectivity, and working temperature parameters. Gadolinium (Gd) doping is widely used in gas sensor applications to increase the sensitivity of gas sensors. In addition, reduced graphene oxide (rGO) materials are commonly used in gas sensor applications to increase gas sensors' selectivity and working temperature. In this study, the effect of Gd doping and the addition of an rGO layer on LFO material was analysed on sensitivity and selectivity based on the adsorption energy of the system with ethanol gas molecules. Density Functional Theory studies were conducted to yield insight into the LGFO or LGFO @ rGO – ethanol gas interactions also the sensitivity and selectivity improvement by adsorption energy. Based on this research, it was found that the presence of Gd doping and single layer rGO could increase the adsorption energy value. The addition of the rGO layer showed an escalation of the adsorption energy value of about 9.45%, - 2.49 eV in the LGFO to - 2.75 eV LGFO @ rGO. This result shows the potential of LGFO and LGFO @ rGO as potential ethanol gas sensor materials.

**Keywords:** LaFeO<sub>3</sub>, Gadolinium, reduce graphene oxide, density functional theory, gas sensor, ethanol



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ANALISIS PENGARUH LAPISAN rGO PADA  $\text{LaFeO}_3$  YANG DI-DOPING Gd SEBAGAI MATERIAL SENSOR GAS ETANOL MENGGUNAKAN DENSITY FUNCTIONAL THEORY

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