# THE INFORMATION OF NEW CONTRIBUTIONS OF THE THESIS

The title of the thesis: **Research on synthesis and modification of ethanol electrooxidation catalysts Pt/rGO and Pd/rGO, apply on the preparation of catalyst ink for the anode in DEFC**

Major: Theoretical and Physical Chemistry

Code: 9.44.01.19

Name of PhD Student: Nguyen Minh Dang

Supervisors: 1. Prof. Dr. VU Thi Thu Ha

2. Prof. Dr. LE Quoc Hung

Educational institution: Vietnam Institute of Industrial Chemistry

## New contributions of the thesis

- ✓ The modified Pd/rGO catalyst by an Al-Si-Na promoter (Pd-Al-Si-Na/rGO) has been successfully synthesized, which has a high activity for the ethanol electrooxidation in an alkaline medium with $I_F$ of 16138 mA $mg_{Pd}^{-1}$. The data is higher than the published ones of the based-on Pd catalyst. The role of Na in increasing the activity durability and anti-poisoning ability of the modified Pd/rGO catalyst was clarified (the $I_F$ value, after 500 cyclic voltammetry cycles, decreased by about 32%), due to the formation of the $NaPd_3O_4$ cubic phase, which has high activity and durability, leads to increased bonding between Pd and rGO support;
- ✓ Ethanol was identified as the most suitable solvent in studied ones (water, n-butylacetate, isopropanol, and ethanol) for preparation of the CI-Pt-Al/rGO catalyst ink, coated on the anode of the direct ethanol fuel cell, allowing the catalyst to show the highest activity in the ethanol electrooxidation, in both acidic medium ($I_F$ is 1456 mA $mg_{Pt}^{-1}$) and alkaline ($I_F$ is 1793 mA $mg_{Pt}^{-1}$). No cracks on the surface of the electrodes were observed after coating the ink. The maximum power density of the direct ethanol fuel cell with the proton exchange membrane) or anion exchange membrane (AEM-DEFC), using the anode reached the highest value, 19.10 mW $cm^{-2}$ and 27.07 mW

$cm^{-2}$, respectively;

- ✓ The anode coated CI-Pd-Al-Si-Na/rGO catalyst ink, for the anode of AEM-DEFC was fabricated. No cracks on the surface of the electrodes were observed after coating the ink. The maximum power density of the DEFC is 43.0 mW $cm^{-2}$. The energy conversion efficiency reached 7.83% after more than 7 hours of work with stable potential at about 0.5 to 0.6 V, higher than the published studies on AEM-DEFC with based-Pd catalysts.

| **Representative supervisor** | **PhD Student** |
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| **Prof. Dr. VU Thi Thu Ha** | **Nguyễn Minh Đăng** |