

Information on Doctoral thesis of Fellows Vo Thi My Nga

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2. Sex: Female
3. Date of birth: 4th November 1982
4. Place of birth: Tuy Hoa, Phu Yen
5. Admission decision number: 3201/QD – SDH, date: 08/11/2010, signed by President of VNU.
6. Changes in academic process: No-Change
7. Official thesis title: "Study on synthesis of Bentonite - mesoporous silica solid acid meso-catalyst systems for cracking heavy hydrocarbons"
8. Major: Petrochemistry
9. Code: 62440115
10. Supervisors: Assoc.Prof.Dr. Hoa Huu Thu

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11. Summary of the new findings of the thesis

a) *Major results* :

- Synthesized successfully the bentonite Di Linh - mesoporous silica material by one -step method quite simple, including : BHSMC, BHSMP, BHMeSMC (Me = Al, Zr, Fe, Sn).
- Investigated the conditions to synthesize BHSMC materials, including: pH = 11 ; aging temperature : 100°C , aging time : 40 hours ; ratio of Si/Bent = 4.6 ; ratio of the surfactant / Bent = 2.4.
- Modified successfully BHSMC and BHSMP materials with metals, such as Al, Zr, Fe, Sn. Their catalytic activity in the cracking reaction Wax was evaluated in the same experimental conditions (the reaction temperature: 460°C and the exposure time: 24s) and the results of activity were arranged in ascending order as follows: BHSn(10)SMC < BHFe(10)SMC < BH < BHSMP < BHSMC < BHZr(10)SMC < BHAl(10)SMC. The gasoline efficiency and the conversion of BHAl(10)SMC: 72.76 % and 88.61 % .
- Assessed the catalytic activity of the Cumen cracking reaction on bentonite- mesoporous silica catalysts and then assessed the catalytic activity of the Wax cracking reaction. The gasoline performance of BHSMC catalyst was higher than gasoline performance of DQS catalyst (DQS: Dung Quat spent catalyst) in the same conditions (the reaction temperature: 460°C and the exposure time: 24s) 9.68 % and the conversion of BHSMC catalyst was higher approximately 8.63 % .

- Durable material with reaction conditions and after burning coke, durable materials with recycled process (after performed reaction 3 times), the gasoline performance and the conversion of BSMCTS2 catalyst achieved 74.58 % and 89.53% at the reaction temperature: 520°C and the exposure time: 24s .

b) Summary of the new findings of the thesis

- For the first time, the bentonite meso-silica composite materials were studied and synthesized in Vietnam with bentonite source of Di Linh, Lam Dong, Vietnam.

- The formation of these combined materials has been shown to have an interaction between the layers of bentonite and silica mesoporous. This process also formed acidic materials. Besides, their pore diameter and surface area are larger than the zeolite.

- The combining of bentonite and silica mesoporous had exploited the advantages of both types of materials.

12. Practical applicability, if any:

Fossil fuels are being used very much in the world as well as in Vietnam. Therefore, to save resources, currently, oil refining Industry has paid attention to thorough exploiting and effective using heavy oil (residue oil) as a feedstock for producing the high-value products such as gasoline, light olefins, transportation fuels, ...etc... or as an important raw to create necessary initial-feedstock products for Petrochemical Industry and Chemical Industry. The raw materials are processed in the catalytic cracking units, in which the C-C bonds of long chain molecules have been broken and formed into shorter chain molecules having more useful and higher economic value, for example: C3 to C10. The quality of product segmentations in this process depends on the properties of every used catalyst type. They are the solid acid catalysts having combined micro – and meso-pores with their high activities in catalytic cracking process to break the C-C bonds through primary-treatment as well as secondary-treatment and be able to withstand heavy metal poisoning such as Ni, V, ...etc...The results of studying on structural and textural properties, the catalytic activity of Cumene model molecule cracking reaction and meso-catalysts Wax cracking reaction ($d_{15Wax} = 0.8431 \text{ g/cm}^3$) confirmed that Bentonite - mesoporous silica synthesized has mesoporous structure and stability suitable for using as the acid catalysts to break the C - C bonds in the hydrocarbon molecules of large molecular weight.

13. Further research directions, if any

- Assessing durability of the catalysts.

- Study combining of industrial cracking catalyst and the synthesized catalysts to get into the catalysts with better characteristics and they can meet the new requirements of an catalyst for catalytic cracking process in Petroleum Industry.

14. Thesis-related publications:

- [1] Vo Thi My Nga, Nguyen Thanh Binh, Hoa Huu Thu, Dang Van Long, Nguyen Thi Thu Huong, (2010), "Di Linh Bentonite modified by mesoporous silica to solid acid catalyst materials for cumene cracking reaction", *VN Journal of Chemistry* 48 (4C), pp.18-25.
- [2] Vo Thi My Nga, Nguyen Thanh Binh, Hoa Huu Thu, Le Van Quy (2011), "Study on preparation of several catalytic systems Dilinh bentonite – mesoporous materials using for cumene cracking", *VN Journal of Chemistry* 49-2(ABC), pp.514-519.
- [3] Vo Thi My Nga, Nguyen Thanh Binh, Hoa Huu Thu, Dang Van Long, Le Van Quy (2011), "Synthesis and study on structural characters and catalytic properties of Dilinh bentonite – mesoporous silica in cumene cracking reaction", *VN Journal of Chemistry* 49 (5AB), pp.463-469.
- [4] Vo Thi My Nga, Nguyen Thanh Binh, Le Thanh Son, Hoa Huu Thu, Nguyen Thi Thu Huong, Truong Quang Truong, Truong Dinh Duc, Do Trung Hieu (2012), "Synthesis and characterization of anionated metals oxide pillared interlayered clays being catalysts applied for n-paraffin isomerization reaction. Part 1. Synthesis, characterization of structural and surface properties of sulfated metals oxide pillared interlayered clays", *VN Journal of science and technology* 50 (3C), pp.583-590.
- [5] Vo Thi My Nga, Nguyen Thanh Binh, Le Thanh Son, Hoa Huu Thu, Nguyen Thi Thu Huong, Truong Quang Truong, Truong Dinh Duc, Do Trung Hieu (2012), "Synthesis and characterization of anionated metals oxide pillared interlayered clays being catalysts applied for n-paraffin isomerization reaction. Part 2. Study on the activities of acide metals oxide pillared interlayered clays being catalysts applied for n-paraffin isomerization reaction", *VN Journal of science and technology* 50 (3C), pp.591-597.
- [6] Vo Thi My Nga, Nguyen Thanh Binh, Le Thanh Son, Hoa Huu Thu, Dang Thanh Tung, Tran Van Tri, Do Trung Hieu, Nguyen Thi Minh Thu (2012), "Study on One-Step Synthesis of Mesostructured Silica-Pillared Montmorillonite and Their Catalytic Activity in Wax Cracking Reaction", *Proceedings, ISBN: 978-604-73-1496-6, ICAEF 2012*, pp.176-181.
- [7] Vo Thi My Nga, Nguyen Thanh Binh, Le Thanh Son, Hoa Huu Thu, Dang Thanh Tung, Tran Van Tri, Do Trung Hieu, Nguyen Sura (2013), "Study on structure formation of mesoporous silica-pillared montmorillonites. Part 2. catalytic activity of the mesoporous silica-pillared montmorillonites in cumen and wax cracking", *VN Journal of Chemistry* 51 (2C), pp.681-685.
- [8] Vo Thi My Nga, Nguyen Thanh Binh, Le Thanh Son, Hoa Huu Thu, Dang Thanh Tung, Do Trung Hieu, Nguyen Thi Minh Thu, Nguyen Le Nhon (2013), "Study wax conversion on bentonite - mesoporous silica modified by metal", *VN Journal of Adsorption and Catalysis* 2 (2), pp.128-135.
- [9] Vo Thi My Nga, Nguyen Thanh Binh, Le Thanh Son, Hoa Huu Thu, Truong Dinh Duc, Bui Vinh Tuong, Ha Luu Manh Quan, Do Trung Hieu (2013), "Study on structure formation of mesoporous silica-pillared montmorillonites", *VN Journal of Adsorption and Catalysis* 2 (3), pp.130-135.