

**WATER DROPLET IMPACT PHENOMENA ONTO
SUPER-HYDROPHOBIC SURFACE**



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A Thesis Submitted in Partial Fulfilment of the Requirements
for the Degree of Master of Science
The Petroleum and Petrochemical College, Chulalongkorn University
in Academic Partnership with
The University of Michigan, The University of Oklahoma,
Case Western Reserve University and Institut Français du Pétrole

2008

512020

Thesis Title: Water droplet impact phenomena on super-hydrophobic surface
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ABSTRACT

4971029063: Petrochemical Technology Program

Patrapee Arcade: Water Droplet Impact Phenomena on Super-Hydrophobic Surface

Thesis Advisors: Assoc. Prof. Sumaeth Chavadej, Prof. Lin Shi-Yow, 107 pp.

Keywords: Water droplet/ Super-hydrophobic surface/ High speed solid state CCD camera/ Droplet rebound.

The water droplet impact phenomena on the super-hydrophobic surface of plasma-treated polypropylene film coated on a glass surface were investigated by using a high-speed solid-state CCD camera. The experiments were conducted at an impact height of 10 mm, with three different sizes of water droplets: 5.9650, 10.9691, and 12.6049 mm³ and impact height of 20 mm with a size of water droplet 11.0941 mm³. The volumes and the center of mass of falling and rebounding droplets obtained from using the 2007 version of AutoCAD software were used to calculate the change in energy stage. The results showed that water droplets of both 5.9650 and 10.9691 mm³ exhibited 4 total rebounds without droplet splash, whereas the largest droplet, 12.6049 mm³, showed only 2 rebounds. The bigger the droplet size, the greater the energy loss. In addition, the greater the initial impact velocity, the greater the energy loss. The movement of center of mass showed that during the water droplet rebound, there were two peaks, unlike a solid particle free falling body having a single maximum peak. The two peak maxima are due to the water moving inside the liquid body during rebounding.

บทคัดย่อ

ภัทร์ระถิ อาเขต : การศึกษาปรากฏการณ์ของหยดน้ำตกกระทบบนพื้นผิวที่มีคุณสมบัติไม่ชอบน้ำสูง (Droplet impact phenomena onto super-hydrophobic surface) อ.ที่ปรึกษา : รศ. ดร. สุเมธ ชวเดช, ศ. หลิน ช่อ โยว 107 หน้า

การศึกษาปรากฏการณ์การตกกระทบของหยดน้ำบนพื้นผิวที่มีคุณสมบัติไม่ชอบน้ำสูงบนผิวของฟิล์มโพลีเอทิลีนที่ปรับปรุงด้วยพลาสมาซึ่งเคลือบบนพื้นผิวแก้วโดยใช้กล้องความเร็วสูง ในการทดลองได้มีการศึกษาตัวแปรสองตัวคือความสูงในการตกกระทบและขนาดของหยดน้ำ ความสูงของหยดน้ำในการตกกระทบที่ความสูง 10 และ 20 มิลลิเมตร และขนาดของหยดน้ำที่ขนาด 5.9650, 10.9691 และ 12.6049 ลบ.มม. ปริมาตรและจุดศูนย์กลางมวลสามารถคำนวณได้จากโปรแกรม AutoCAD เวอร์ชัน 2007 โดยข้อมูลที่ได้นำไปใช้ศึกษาการเปลี่ยนแปลงของระดับพลังงานของหยดน้ำที่สูญเสียไปจากการตกกระทบบนพื้นผิว จากผลการทดลองแสดงให้เห็นว่า หยดน้ำขนาด 5.9650 และ 10.9691 ลบ.มม. สามารถกระดอนขึ้นจากพื้นผิวได้ถึง 4 ครั้ง ในขณะที่หยดน้ำขนาด 12.6049 ลบ.มม. สามารถกระดอนได้เพียง 2 ครั้ง ผลการทดลองบ่งชี้ว่าหยดน้ำที่มีขนาดใหญ่กว่าจะมีแนวโน้มที่จะเสียพลังงานในการตกกระทบมากกว่าหยดน้ำที่มีขนาดเล็กกว่า เช่นเดียวกับหยดน้ำที่มีตกกระทบจากที่สูงกว่าซึ่งมีความเร็วสูงกว่าจะมีแนวโน้มที่จะสูญเสียพลังงานมากกว่าหยดน้ำที่มีความเร็วในการตกกระทบต่ำกว่า ยิ่งกว่านั้นจากการศึกษาการเคลื่อนไหวของศูนย์กลางมวลสารของหยดน้ำพบว่า ที่จุดสูงสุดในการกระดอนในแต่ละครั้งมีถึงสองจุดด้วยกัน ซึ่งไม่เหมือนกับการกระดอนของของแข็งที่จะมีจุดสูงสุดเพียงจุดเดียวเท่านั้น ทั้งนี้เนื่องจากการเคลื่อนที่ของมวลสารภายในหยดน้ำในขณะที่กระดอนขึ้น

ACKNOWLEDGEMENTS

This thesis work was partially funded by the National Center of Excellence for Petroleum, Petrochemicals and Advanced Materials, under the Ministry of Education and the Research unit of Applied Surfactants for Separation and Pollution Control, Chulalongkorn University.

First of all, I would like to thank Assoc. Sumaeth Chavadej who gave me an opportunity to conduct this research in Taiwan. Secondly, I would like to thank Prof. Lin Shi-Yow and Prof. Wang Meng-Jiy, at the Department of Chemical Engineering, National Taiwan University of Science and Technology, for advising me how to conduct my experiment. Mr. Aaron, Kelvin, Matt, Khoan, and Arief, M.S. students in the Surface Phenomena Lab who helped me everything during I stayed in Taiwan.

Moreover, I would like to thank all of faculty staffs and my friends in the Petroleum and Petrochemical College who share our happy time during these 2 years.

Finally, I would like to thank my family and my girlfriend who always are my side and give me warm care and love.

TABLE OF CONTENTS

	PAGE
Title Page	i
Abstract (in English)	iii
Abstract (in Thai)	iv
Acknowledgements	v
Table of Contents	vi
List of Tables	viii
List of Figures	x
CHAPTER	
I INTRODUCTION	1
II LITERATURE REVIEW	3
III EXPERIMENTAL	9
3.1 Experimental Set up	9
3.1.1 Light source unit	9
3.1.2 Droplet generator unit	10
3.1.3 Image capture unit	11
3.1.4 Support unit	12
3.2 Studies liquid and solid substrate	12
3.3 Experimental procedure	13
3.3.1 Data grabber	13
3.3.2 Data analysis	14
IV RESULTS AND DISCUSSION	17
4.1 The Change of Center of Mass	17

CHAPTER	PAGE
4.2 Internal Oscillation of Rebounding Droplet	21
4.3 Peak of Maxima	23
4.4 The Change in Projection Area	25
4.5 The Change in Center of Mass in Horizontal Direction	28
4.6 Energy Loss during impact process	29
4.7 Effect of Droplet Size	30
4.8 Effect of Droplet Impact Velocity	35
4.9 Energy Balance	38
V CONCLUSIONS AND RECOMMENDATIONS	40
REFERENCES	43
APPENDICES	45
Appendix A Ball Calibration	45
Appendix B Needle calibration	50
Appendix C Pendant drop calibration	52
Appendix D Sessile drop calibration	54
CURRICULUM VITAE	56

LIST OF TABLES

TABLE		PAGE
4.1	Impact velocity and minimum impact height of water droplet having size of 10.9691 mm ³ with an initial impact velocity of 0.4362 m/s onto the CF ₄ plasma-treated polypropylene film coated on a glass surface	19
4.2	The change in the x and y radius of a water droplet having size 10.9691 mm ³ with initial impact velocity of 0.4362 m/s onto the CF ₄ plasma-treated polypropylene film coated on glass surface during a) y radius, b) x radius	23
4.3	Impact time and rebound time of the 1 st impact and 1 st rebounds of a water droplet onto the CF ₄ plasma-treated polypropylene film coated on a glass surface with different droplet sizes	31
4.4	The 1 st maximum rebound height and the 1 st minimum impact height of water droplet onto plasma-treated polypropylene film coated on a glass surface at different droplet sizes	32
4.5	Spreading and receding velocity of droplet having different size during 1 st impact process	33
4.6	Average radius in Y direction and standard deviation of droplet having different sizes during the 1 st rebound process	34
4.7	Initial impact velocity of water droplet onto plasma-treated polypropylene film coated on a glass surface with different impact velocity by varying volume of water droplet.	35

TABL	PAGE
E	
4.8 The 1 st maximum rebound height and 1 st minimum impact height of water droplet onto the CF ₄ plasma-treated polypropylene film coated on a glass surface with different impact velocity	36
4.9 Spreading and receding velocity of a water droplet having different initial impact velocity during 1 st impact process	37
4.10 Average radius in Y direction and standard deviation of droplet having different initial impact velocity during 1 st rebound process	38
4.11 Maximum height, Potential energy, energy loss, and ratio of energy loss	
a. $V = 12.6049 \text{ mm}^3$ and $v = 0.4344 \text{ m/s}$,	
b. $V = 10.9691 \text{ mm}^3$ and $v = 0.4362 \text{ m/s}$	
c. $V = 5.9650 \text{ mm}^3$ and $v = 0.4541 \text{ m/s}$,	
d. $V = 11.0641 \text{ mm}^3$ and $v = 0.6476 \text{ m/s}$	39

LIST OF FIGURES

FIGURE		PAGE
2.1	6 Types of outcomes of water droplet impact (Rioboo <i>et al</i> , 2001)	4
2.2	Four stages of the proposed impact process (Mao <i>et al</i> , 1997)	6
2.3	Rebound pattern of glycerin droplets on incline surfaces (Šikalo <i>et al</i> , 2005)	7
3.1	Experimental set-up in this study	9
3.2	Set up of a) Light source b) series of lens and filter	10
3.3	a) A droplet generator unit, b) syringe, and c) needles	10
3.4	a) Monitors and b) Computer and CCD camera power supply	11
3.5	High-speed solid state CCD cameras	11
3.6	a) Cover box before wrapped with black paper b) Cover box after wrapped with black paper and c) Vibration-Isolation table	12
3.7	Plasma-treated polypropylene film coated on a glass surface	13
3.8	a) Image of water droplet taken from the high-speed solid state CCD camera, b) Plot of edge location from GRAPHER 4.0 program	14
3.9	Simulated water droplet from 2007 AutoCAD a) Left half, b) right half	15
3.10	Combine of simulated water droplet from 2007 AutoCAD simulation program	16

FIGURE		PAGE
4.1	The profiles of center of mass of water droplet having size 10.9691mm^3 with an initial impact velocity of 0.4362 m/s onto CF_4 plasma-treated polypropylene film coated on a glass during (o) rebound phase (+) impact phase	18
4.2	The profiles of center of mass of water droplet having size 10.9691mm^3 with initial impact velocity 0.4362 m/s onto CF_4 plasma-treated polypropylene film coated on a glass during (+) impact phase	18
4.3	Movement of water droplet during contacting, spreading, recoiling, and detaching	19
4.4	The profiles of center of mass of water droplet having size 10.9691mm^3 with initial impact velocity 0.4362 m/s onto CF_4 plasma-treated polypropylene film coated on a glass during (o) rebound phase	20
4.5	The change of radius in the x and y radius with time of the water droplet having size of 10.9691 mm^3 with an initial impact velocity of 0.4362 m/s onto CF_4 plasma-treated polypropylene film coated on glass surface during a) 1 st rebound, b) 2 nd rebound, c) 3 rd rebound, and d) 4 th rebound	22
4.6	Peaks of maxima of a water droplet having 10.9691 mm^3 with impact velocity of 0.4362 m/s onto the CF_4 plasma-treated polypropylene film coated on a glass surface	24
4.7	The change of center of mass with time of a water droplet having 10.9691 mm^3 with impact velocity of 0.4362 m/s onto the CF_4 plasma-treated polypropylene film coated on a glass surface during the first rebound	25

FIGURE	PAGE
4.8 The change in projection area with time of a water droplet having 10.9691 mm^3 with initial impact velocity of 0.4362 m/s onto the CF_4 plasma-treated polypropylene film coated on a glass surface	26
4.9 Image of water droplet having 10.9691 mm^3 with initial impact velocity of 0.4362 m/s onto the CF_4 plasma-treated polypropylene film coated on a glass surface of droplet volume during 1 st impact at a) spreading phase and b) recoiling phase	26
4.10 The change of projection area and droplet 2D-volume with time of water droplet having size 10.9691 mm^3 and initial impact velocity 0.4362 m/s onto plasma-treated polypropylene film coated on glass surface during a) 1 st rebound, b) 2 nd rebound, c) 3 rd rebound, and d) 4 th rebound	27
4.11 Image of water droplet having 10.9691 mm^3 with initial impact velocity of 0.4362 m/s onto the plasma-treated polypropylene film coated on glass surface during a) 1 st rebound and b) 2 nd rebound	28
4.12 The change in center of mass in horizontal direction with time of water droplet having 10.9691 mm^3 volume with initial impact velocity of 0.4362 m/s onto the CF_4 plasma-treated polypropylene film coated on a glass surface	29
4.13 The change of center of mass with time of a different initial sizes of water droplets, at initial impact height of 10 mm onto the CF_4 plasma-treated polypropylene film coated on a glass surface: a) (o) 5.9650 , b) (\diamond) 10.9691 ,	

and c) (Δ) 12.6049 mm³ 31

FIGURE	PAGE
4.14 Small droplet splitting out during the 1 st impact of a water droplet having 12.6049 mm ³ with impact velocity of 0.4344 m/s onto the CF ₄ plasma-treated polypropylene film coated on a glass surface	32
4.15 The change in radius in X direction with time of droplet having different size during 1 st impact process a. (o) 5.9650, b. (\diamond) 10.9691, and c. (Δ) 12.6049 mm ³	33
4.16 The change in radius in y direction with time of rebounding droplet having different sizes during the 1 st rebound process a. (o) 5.9650, b. (\diamond) 10.9691, and c. (Δ) 12.6049 mm ³	34
4.17 Small droplet came off during 1 st impact of water droplet having size 12.6049 mm ³ with impact velocity 0.6476 m/s onto CF ₄ plasma-treated polypropylene film coated on a glass surface	35
4.18 The change of center of mass with time of water droplet having different sizes onto CF ₄ plasma-treated polypropylene film coated on a glass surface a. (o) V = 10.9691mm ³ v 0.4362 m/s, b. (\diamond) V =11.0641, v = 0.6476 m/s	36
4.19 The change in radius in X direction with time of a water droplet having different impact velocity during the 1 st impact process a. (o) 0.6476, b. (\diamond) 0.4362 m/s	37
4.20 The change in radius in Y direction with time of rebounding droplet having different initial impact velocity during 1 st rebound process a. (o) 10.9691 and b.	

(◇) 11.0641 mm^3