

# 摻雜不同濃度碳的二氧化鈦薄膜之電子結構與磁性研究

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## 中文摘要

本研究中，我們利用固態燒結法製備摻雜碳的二氧化鈦粉末，再使用油壓機和箱形爐來對粉末加壓和加熱，使其成為塊材。接著我們使用脈衝雷射鍍膜系統進行鍍膜，並在一系列成長條件下探討碳摻雜對二氧化鈦磁性造成的效應和機制。我們發現摻雜碳的二氧化鈦有明顯的磁滯曲線，顯示碳摻雜確實會形成室溫鐵磁性。本論文藉由 C-1s 和 Ti-2p 之 XPS 量測，發現薄膜中有鈦和碳的鍵結與氧空缺，顯示摻碳二氧化鈦的鐵磁性來源，是由氧空缺與雜質間相互作用所產生。從 O-1s 的 XPS 也可以看出，摻雜碳可使氧空缺變多，此可能進而產生更多電子。本實驗也發現隨著碳的摻雜濃度增加，鐵磁性並未維持一直增加的趨勢，甚至反而減弱材料的室溫鐵磁性，本論文亦將對此現象，提出初步的解釋。

# Electronic structure and magnetism in $\text{TiO}_2$ thin films doped with different concentrations

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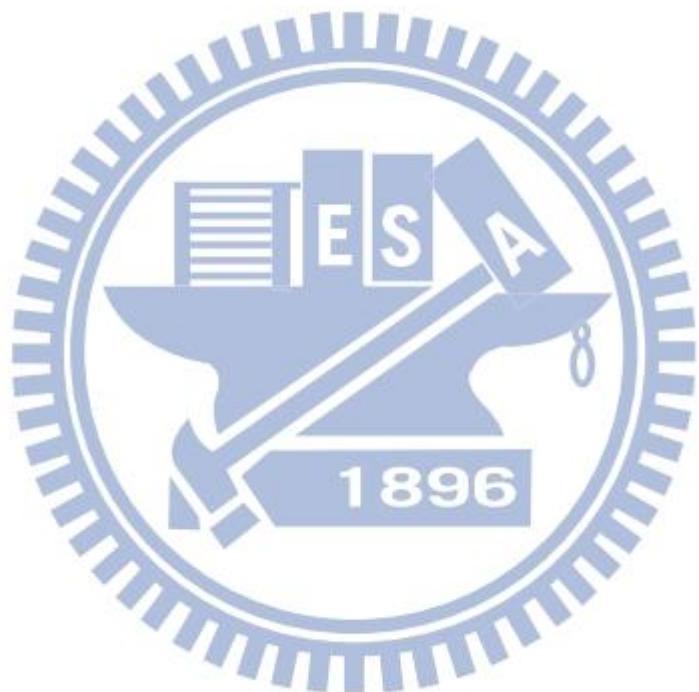
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Carbon-doped titanium dioxide powders was prepared by solid state sintering at  $1200^\circ\text{C}$  for 24hrs to produce  $\text{TiO}_2$  bulks with different carbon doping concentrations. The obtained  $\text{TiO}_2$  bulks were then used to deposit  $\text{TiO}_2$  thin films by pulsed laser deposition. The effects of carbon doping was investigated via a series of films obtained at various deposition conditions. The results indicate that the carbon-doped titanium dioxide evidently exhibit significant magnetization hysteresis at room temperature, indicating the realization of room-temperature ferromagnetism (RTFM).

Further X-ray photoelectron spectroscopy (XPS) analysis on C-1s, O-1s, and Ti-2p electronic states showed the existence of Ti-C bonding and significant

amount of oxygen vacancies. These results lend support to the p-p interaction, induced ferromagnetism in these oxides. The observed RTFM, however, did not increase with increasing doping concentration of carbon, presumably due to the excessive free carbon-induced diamagnetism.



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# Contents

Abstract (in Chinese)	i
Abstract (in English)	ii
Acknowledgement	iv
Contents	vi
List of Figures	viii
Chapter 1 Introduction	1
1-1 Magnetic materials and semiconductors	1
1-2 Diluted Magnetic Semiconductors (DMSs)	3
1-2.1: What's DMS	3
1-2.2: Types of DMSs	5
1-2.3: The development of DMSs	8
1-2.4: Why DMSs are so important?	14
1-3 Titanium dioxide	15
1-3.1: Photocatalyst	15
1-3.2: Literature review of $\text{TiO}_2$	16
1-3.3: The crystal structure of titanium dioxide	23
1-3.4: $\text{TiO}_2$ -based materials	25
1-3.5: 2p-light element doped DMSs	26
1-4 Motivation	28
Chapter 2 Background	29
2-1 Brief introduction to magnetism	29
2-2 Types of magnetism	32
2-3 The mechanism and source of magnetism in DMSs	38
2-3.1: Bound magnetic polaron (BMP)	42
2-3.2: Mechanism of exchange interaction	44

<b>Chapter 3 Experiments and Instruments</b>	<b>48</b>
3-1    Sample preparation	48
3-1.1: Target fabrication	48
3-1.2: Pulsed laser deposition (PLD)	49
3-2    Structure analysis by XRD	50
3-3    Analysis of magnetism	51
3-3.1: Introduction of the SQUID	51
3-3.2: The principle of Josephson junctions	53
3-4    Surface electronic structure analysis	54
3-4.1: What's X-ray Photoelectron Spectroscopy?	54
3-4.2: Chemical State Identification	55
3-5    X-ray absorption near edge structure (XANES)	57
<b>Chapter 4 Results and discussion</b>	<b>60</b>
4-1    The characteristics of carbon-doped TiO <sub>2</sub> powders	60
4-1.1: Structure Analysis of powders by X-ray Diffraction(XRD)	60
4-1.2: Magnetic analysis of powders by SQUID	61
4-2    The characteristics of carbon-doped TiO <sub>2</sub> thin films	64
4-2.1: Structure analysis of thin films by X-ray Diffraction	64
4-2.2: Magnetic analysis of thin films by SQUID	66
4-3    Surface electronic structure analysis by XPS	67
4-4    Diamagnetic effect caused by excessive carbon	72
4-5    XANES analysis	74

Chapter 5 Conclusions	76
References	78

## List of Figures

Fig. 1.1	Schematic illustration of (A) magnetic semiconductor (B) diluted magnetic semiconductor; and (C) nonmagnetic semiconductor.	4
Fig. 1.2	(a) Comparisons of II-VI DMSs, III-V DMSs, and oxides. (b) Curie Temperature for various p-type semiconductors (c) Bandgap versus lattice constant at room temperature for common elemental and binary compound semiconductors.	7
Fig. 1.3	Hall resistivity as a function of applied magnetic field measured at different temperatures for (Ga, Mn)N.	10
Fig. 1.4	(a) The M-T curve of Mn-doped ratio of 9% by Sonoda. (b) The M-T curves of Mn-doped ratio of A (12%) and B (1.4%) by Hashimo.	11
Fig. 1.5	Zn <sub>1-x</sub> Co <sub>x</sub> O of (a) M-T Curves (b) M-H Curves.	12
Fig. 1.6	M-H curves of sintered ZnMnO.	13
Fig. 1.7	Schematics showing the characteristics and applications of TiO <sub>2</sub> .	14
Fig. 1.8	By OPA-MBE growth of single crystal Co <sub>x</sub> Ti <sub>(1-x)</sub> O <sub>2</sub> film of the RHEED (a and d), SEM images (b and e) and Auger intensity maps (c and f).	15
Fig. 1.9	The M-T (ZFC-FC) curves of Co <sub>x</sub> Ti <sub>(1-x)</sub> O <sub>2</sub> thin films with 0.01 $\leq$ x $\leq$ 0.12.	17
Fig. 1.10	(a) SEM image of Ti <sub>0.95</sub> V <sub>0.05</sub> O <sub>2</sub> growth at 700°C. (b) M-T curves of Ti <sub>0.95</sub> V <sub>0.05</sub> O <sub>2</sub> at different growth temperatures	18
Fig. 1.11	Structures of anatase and rutile phase TiO <sub>2</sub> .	20
Fig. 2.1	The g value of various magnetic materials.	24
Fig. 2.2	The schematic illustration of paramagnetism.	31
Fig. 2.3	$\chi^{-1}$ -T curve of Langevin paramagnetism.	32
Fig. 2.4	Characteristic in magnetic susceptibilities of diamagnetism and paramagnetism.	32
Fig. 2.5	Hysteresis curve of ferromagnetic materials.	33
Fig. 2.6	(a) Diamagnetism (b) Paramagnetism (c) Ferromagnetism.	34
		35

Fig. 2.7	Ordered arrangements in electron spins.	36
Fig. 2.8	Ferrimagnetism	37
Fig. 2.9	Ordering of magnetic dipoles in a various of magnetic materials	37
Fig. 2.10	The model of localized carrier theory.	40
Fig. 2.11	The model of itinerant carrier theory.	41
Fig. 2.12	BMP Model	43
Fig. 2.13	Schematic that depicts the hoping processes in double exchange	45
Fig. 2.14	Schematics depicting the hopping processes in super exchange and double exchange.	46
Fig. 2.15	Schematics illustrating (a) direct exchange (b) super exchange (c) indirect exchange	47
Fig. 3.1	Illustration of XRD process.	51
Fig. 3.2	Schematic illustration of SQUID.	52
Fig. 3.3	Josephson junctions	53
Fig. 3.4	Josephson Circuit	53
Fig. 3.5	X-ray Photoelectron Spectroscopy (XPS).	55
Fig. 3.6	Schematic illustration of XANES.	58
Fig. 4.1	The XRD of initial three kinds of powders.	61
Fig. 4.2	The M-H curves of the three kinds of powders.	62
Fig. 4.3	(a) XRD of pure $\text{TiO}_2$ thin film at $400^\circ\text{C}$ and 0.2torr. (b) XRD of 2%C-doped $\text{TiO}_2$ thin film. (c) XRD of 5%C-doped $\text{TiO}_2$ thin film. (d)The comparison of XRD of 5%C-doped and 2%C-doped $\text{TiO}_2$ thin films.	64 65
Fig. 4.4	The M-H curves of the three kinds of thin films	66
Fig. 4.5	XPS of Ti 2p (Titanium dioxide with 0% carbon).	68
Fig. 4.6	XPS of Ti 2p (Titanium dioxide with 2% carbon).	68

Fig. 4.7	XPS of Ti 2p (Titanium dioxide with 5% carbon).	69
Fig. 4.8	XPS of C 1s (Titanium dioxide with 0% carbon).	69
Fig. 4.9	XPS of C 1s (Titanium dioxide with 2% carbon).	70
Fig. 4.10	XPS of C 1s (Titanium dioxide with 5% carbon).	70
Fig. 4.11	XPS of O 1s (Titanium dioxide with 0% carbon).	71
Fig. 4.12	XPS of O 1s (Titanium dioxide with 2% carbon).	71
Fig. 4.13	XPS of O 1s (Titanium dioxide with 5% carbon).	71
Fig. 4.14	Analysis of excessive magnetic moment.	72
Fig. 4.15	The Ti L-edge XANES.	74

