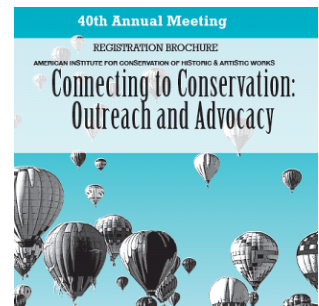


# 第 40 屆美國文物保護協會 國際研討會論文發表

## 成果報告書



姓名：辜貞榕

## 壹、前言

美國文物保護協會(American institute for conservation of historical and artistic works 簡稱AIC)為國際文物保護專業之專業組織，其設置宗旨乃藉由研究、出版、知識交流、專業標準的建立，加強文物修護工作與促進文化遺產維護的重要性，並於每年5月固定舉辦研討會，為北美地區修護師與文物保存工作者發表與交流文物保護相關議題最具權威與指標的會議，於此發表文章可大幅提昇台灣在文物保存維護領域的國際能見度。

第40屆的研討會於2011年8月進行論文徵集，於2011年11月公布講者名單並於同年12月正式邀請講者赴美進行演說。紙張與書籍分組專題演說一年發表文章約有10篇，本篇論文“**Study on the Influence of Gunpowder Residues Found in Paper-Based Materials**”為其中一篇。其餘發表者多為美國博物館中的紙質、書籍資深修護師或研究人員。

2012年5月8日至5月11日在美國阿布奎基(Albuquerque)舉辦，此會議內容專業而豐富，大致可將其分為總論演說、工作坊、分組專題演說、文物保存用品廠商攤位展示與文保修護技術研究海報發表、實地參訪博物館等幾個大項分日進行。此區域的博物館與美術館多為美國西南部地區相當著名的典藏機構，在保存技術與修護能力上均成效顯著極具代表性，協會透過安排進行參訪讓與會者可以與當地的典藏修護人員進行第一線的接觸與討論。AIC研討會理論與實務兼具，為汲取文物修護新知與典藏保存技術之重要管道，有助於專業典藏人員提升專業知識與新知，進而推動台灣優質典藏管理與文物保護工作。

## 貳、邀請函

Dear Tsen-Jung,

On behalf of the Book and Paper Group Abstract Review Committee, I would like to invite you to present your paper *Study on the Influence of Gunpowder Residues Found in Paper-Based Materials* during the Book and Paper session at the 40<sup>th</sup> annual AIC meeting in Albuquerque May 8-11, 2012.

We need the following by **Friday, October 14th**:

- Confirmation that you will be able to attend the conference – BPG sessions run on Wednesday afternoon, Thursday morning and all day Friday. If you absolutely cannot present during one of those times, please let me know when you confirm your acceptance.
- For the registration booklet, we need confirmation of the title of the talk and speaker's name(s)/affiliation in the order in which you would like them to appear. Only speakers will be listed in the event of multiple authors.

If your abstract is over 500 words, we need an edited version for the abstract book by January 15th. If we do not receive your edited abstract in time for the publication deadline, your abstract will be edited by the BPG Committee. Also, if you have any special AV equipment besides the usual microphone/ lectern/PowerPoint setup, we will try to accommodate them as best we can. This is somewhat dependant on the hotel's AV capabilities – the sooner we know, the better.

Remember that presenters are required to register for the conference day during which they will be presenting, if not the entire conference. We look forward to your participation in the 2012 BPG session. Please feel free to contact me with any questions.

Thank you,

Jamye Jamison

2012 BPG Program Chair

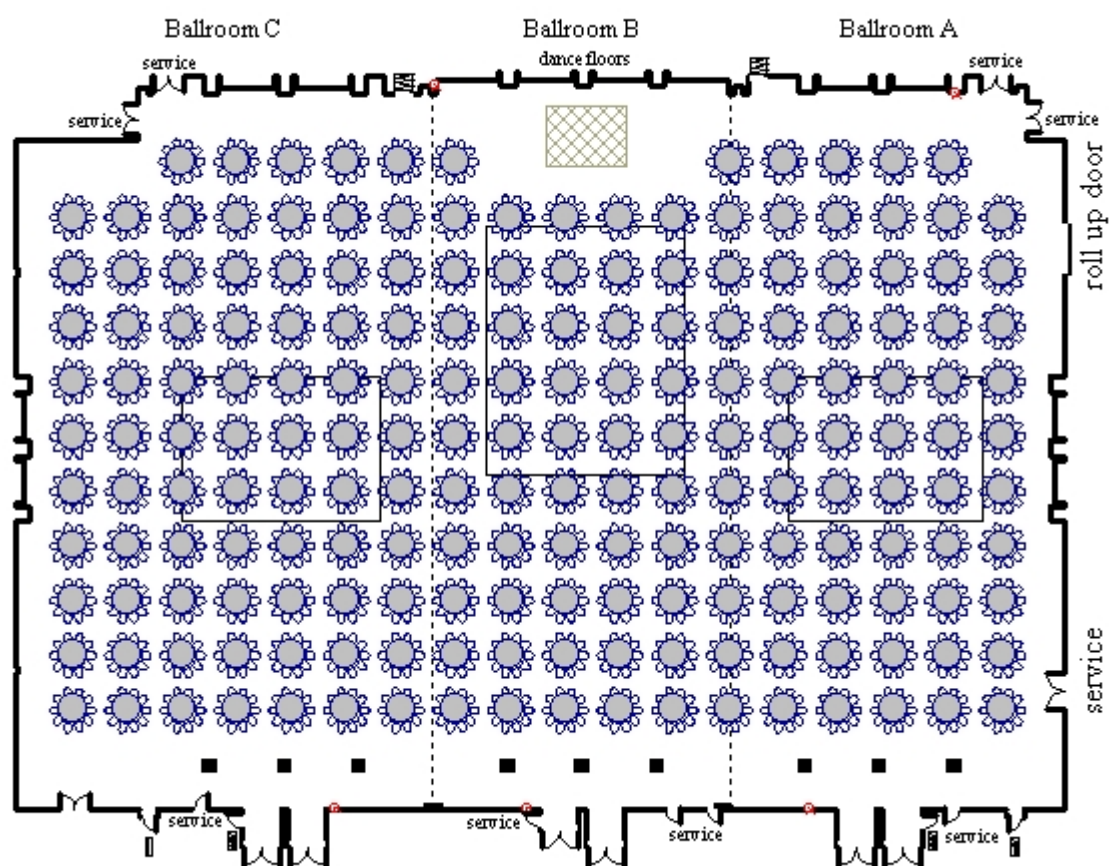
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## 參、會議地點

阿布奎基會議中心 (Albuquerque Convention Center, NM)，位於美國新墨西哥州，發表會場為其 Ballroom A/B/C，約可容納 2000 人次。

Room	Location	Dimensions	Total Sq Ft	Ceiling Height	Capacity
Ballroom A/B/C	West Complex	211'x147'	31164	16'	Banquet: 1910 Classroom: 1360 Theater: 2400

### BANQUET





## 肆、論文摘要

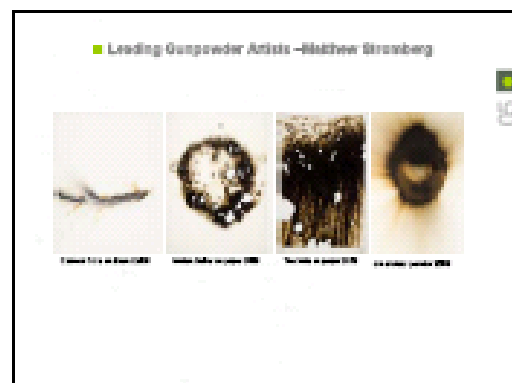
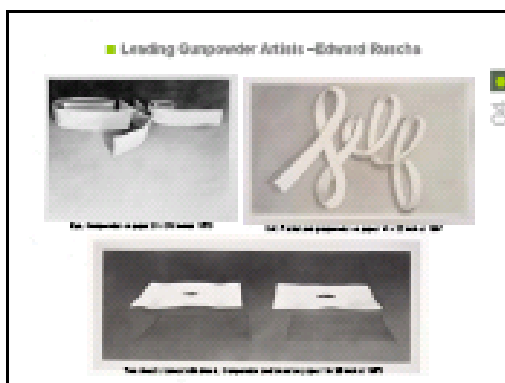
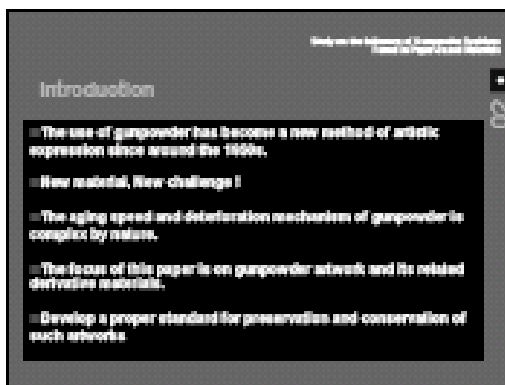
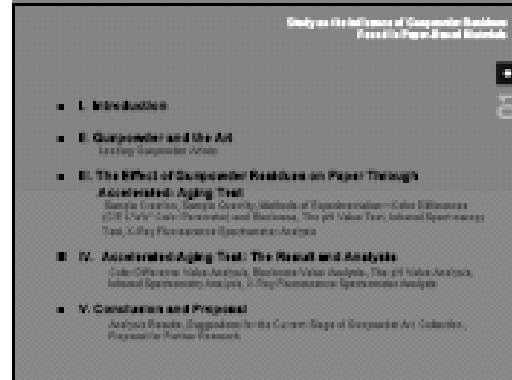
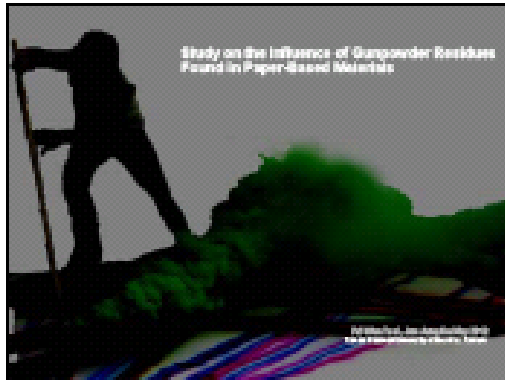
### Study on the Influence of Gunpowder Residues Found in Paper-Based Materials

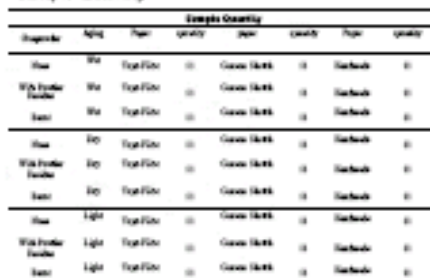
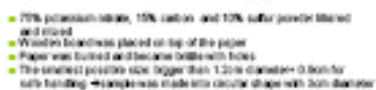
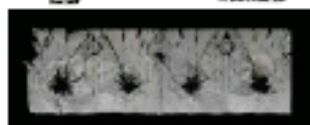
Material science has always being an important element in the field of collection preservation and restoration, because the property of the material itself affects the preservation and life expectancy of the work. Gunpowder is a modern medium and the use of it in artwork is a recent phenomenon. Although there is not much investigation into the use of gunpowder in art, with the increased appearance of such types of artwork, further research in the preservation of collections involving gunpowder becomes a necessity. This research project focuses on the use of gunpowder material on paper-based artworks. Three accelerated-ageing experiments were carried out to investigate the effect of gunpowder residue on paper.

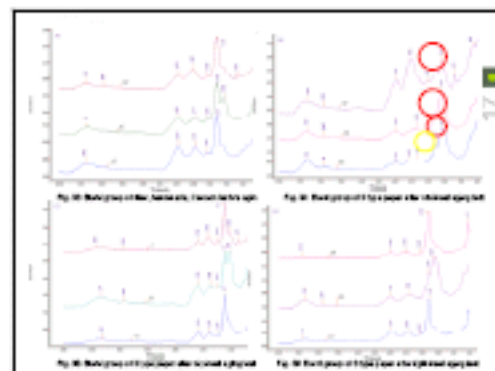
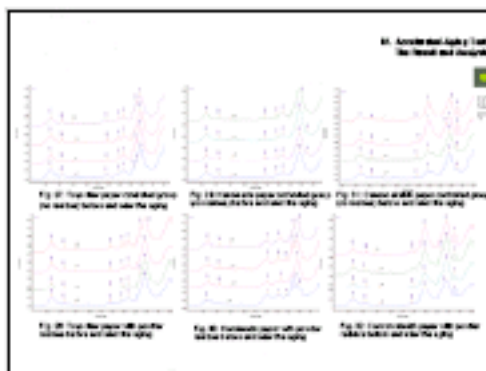
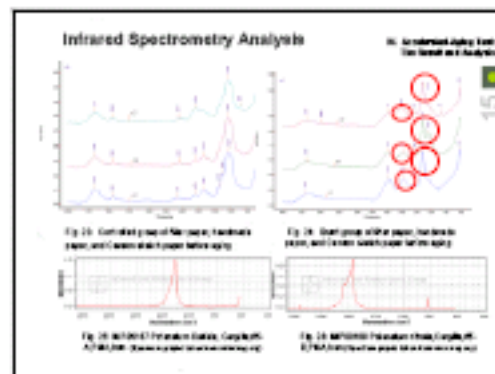
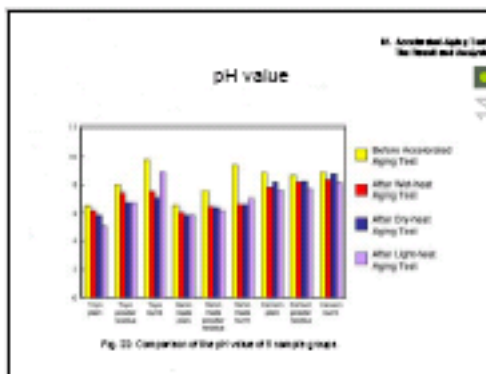
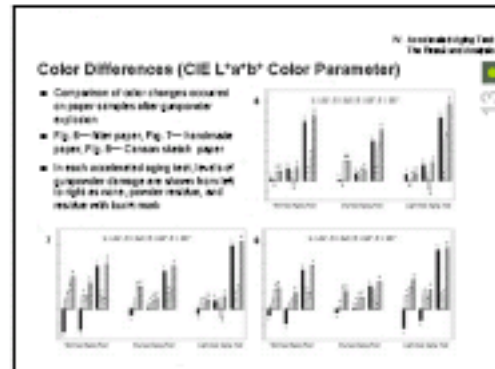
The experiment used a mixture of potassium nitrate, carbon and sulfur as the gunpowder sample. The mixture was applied to three paper-samples with different properties for levels of explosion tests. The paper samples were then placed into an accelerated-ageing chamber with different humidity, heat and light levels. Changes in the optical, physical and chemical properties of the paper samples after the deterioration were analyzed through the use of automated color measurements, acidity tests, and FTIR tests. The data from this experiment suggested that the paper sample containing the most gunpowder residue changed its color the most after deterioration. At the same time, the brightness of this sample increased compared to  $a^*$  and  $b^*$  values. Our preliminary deduction of the cause of color change in this sample was the deterioration and falling off of the gunpowder residue. The experiment data also suggested that the gunpowder residue changed the acidity of paper samples. Paper samples containing gunpowder residue had a higher pH value reading compared to the samples after the aging test. The pH value was maintained between pH 7 to pH 9. The FTIR-ATR spectrum of the samples showed little change before and after the aging test. After comparing the data from the before and after spectrums, it was apparent that no new substance was produced after the aging test, and there was negligible interaction between the gunpowder residue itself and paper samples.

This research paper outlines and explains experiments done on collection materials containing gunpowder and findings from it. From the experiment result, we predict that the most common deterioration in such kind of collection material is the falling off of the gunpowder from the work itself. Therefore, a way to ensure the stable affixation of the gunpowder on the base material of the work is urgently required for the preservation of this kind of work today.

## 伍、發表投影片







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### X-Ray Fluorescence Spectrometer Analysis

- JEOL JXA-8000 (JEOL Instrument Inc.) was used for the X-ray Fluorescence Spectrometer (XRF) analysis.
- Sulfur and potassium have stronger A cps.
- Sulfur and potassium have lower sensitivity to light in this experiment.



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### Conclusion

#### ■ Analysis Results

1. Color Differences : The color difference value dropped from samples with large amounts of gunpowder residue to much bigger compared to values obtained from samples with less or no gunpowder residue.
2. pH value : Aged samples with gunpowder residue have higher concentration of hydroxide in their test solution compared to the test solution of aged samples without gunpowder residue. The overall pH value of samples after the accelerated aging test is in the range of 7 to 9.
3. Infrared Spectrometry Analysis : There was not apparent similarity between the gunpowder and the paper during the accelerated aging test, and there are no new substances produced after the aging process.


#### ■ Possible Deteriorations

- The fastest problem to consider is how to keep the gunpowder safely stored in the stacks.
- Gunpowder and explosives sites can contain hazardous substances such as potassium sulfide and potassium nitrate, which may contribute to the deterioration.

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### Proposal for Further Research

1. The accelerated-aging test : Was done up to 660 hours, but further research should be done with longer aging hours to examine the deterioration condition.
2. Other types of explosives : This research focused only on gunpowder (black powder).
3. The stabilization of gunpowder : How to stabilize the gunpowder without changing its physical texture would be another subject worth further exploration.



**Thank you !**

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## 陸、照片紀錄



會議地點：Albuquerque Convention Center, NM,USA



報到櫃檯與會議流程說明區



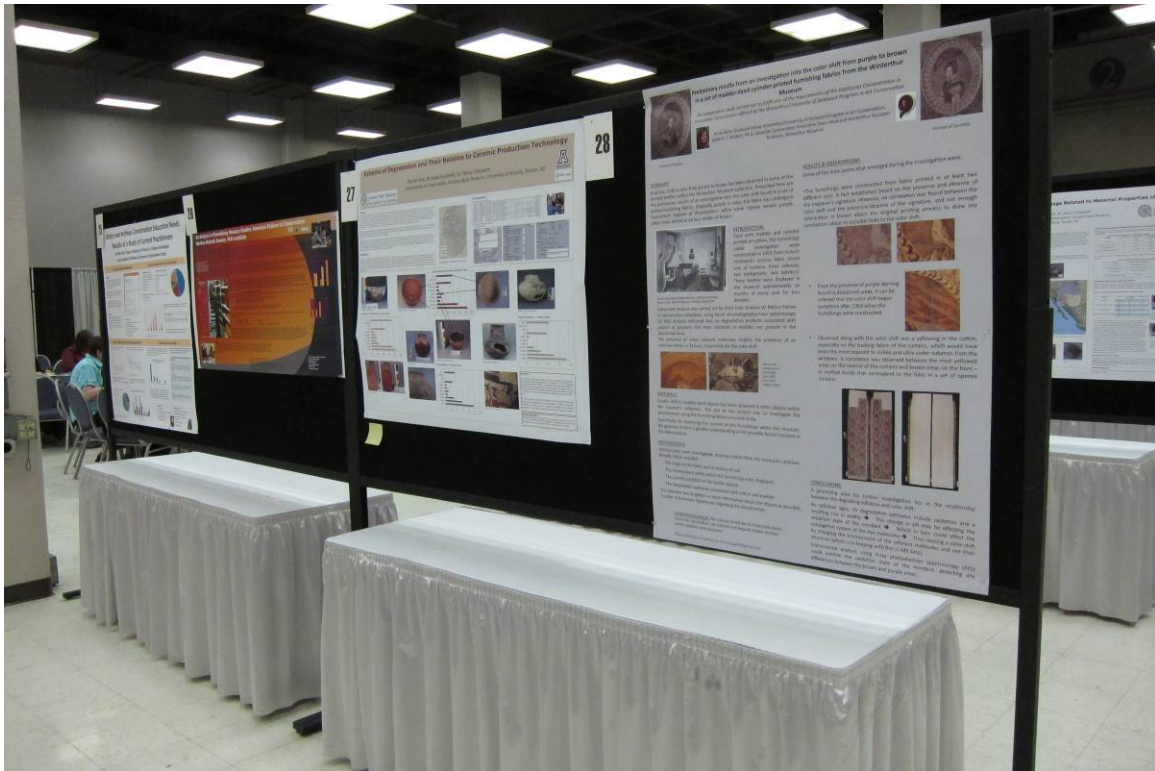
論文發表進行中

講題：Studies on the Influence of Gunpowder Residues Found in Paper-Based Materials



論文發表現場





文物保護技術研究海報技術展示



文物保存用品廠商攤位展示



## 陸、會議手冊