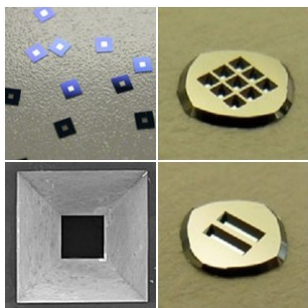


低应力氮化硅薄膜窗口



SHNTI 的氮化硅薄膜窗口是一款价格非常优惠的产品，应用也非常广泛。它可以应用在 TEM、X-Ray、SEM 等等分析测试上。氮化硅薄膜窗口用在 TEM 上，可以完全避免碳膜的背景影响……

氮化硅薄膜窗口用在 X-Ray 上能够实现软 X-射线（如真空紫外线）的最大透射率。X-射线越软，能量越低，穿透能力越差，所需氮化硅薄膜窗口越薄。特别在“离轴”状态工作（即薄膜与光束成一定角度）时，也需要较薄的薄膜窗口，便于 X 射线的更好穿透。

氮化硅薄膜窗口用在 SEM 上，作为耐用基片，首先在 TEM 下，然后在 SEM 下对同一区域进行“匹配”，以及对 AFM 和 TEM 图像进行比较。

现有技术一般采用计量式或 ST 氮化硅薄膜，但或 ST 薄膜具有较高的残余应力，不够结实，容易破裂。而且基于 X-射线显微透射成像需要，氮化硅薄膜对软-X 射线必须满足有较小的吸收。SHNTI 提供的氮化硅薄膜窗口是一种低应力的承载工具（也可以作为微型培养皿、支撑膜），改进了原有技术的缺陷。

SHNTI 氮化硅薄膜窗口的特性：

1、透光性

有时我们会提到薄膜窗口透光性能，即视觉上其可以“透视”。如在透光显微镜下，薄膜只有超过一定厚度，透光性能才会减弱。在估算薄膜的透光性能时，应当注意吸收界限，如果需要考虑光学性能，吸收界应低于 13nm，当吸收界限为 13nm 时，100nm 厚的薄膜透光度为 44%；吸收界限为 12.4nm 时，透光度降为 13%。

2、平整性

氮化硅薄膜窗口成膜光滑，强度大、致密性好，表面平整性很稳定（粗糙度小于 1nm），在一般情况下对于应用没有负面影响。我们可以通过 AFM 表征结果看到，氮化硅薄膜的表面情况。

3、耐高温

可应用于高温领域，能够承受 1000 度高温，非常适合在硅晶片衬底表面利用 CVD 方法生长各种纳米材料。氮化硅本身是一种超硬物质，具有润滑性，并且耐磨损，为原子晶体；高温时抗氧化。而且它还能抵抗冷热冲击，在空气中加热到 1 000 °C 以上，急剧冷却再急剧加热，也不会碎裂。

4、化学惰性

除了 HF 酸，不与其他无机酸反应。

5、亲水性

SHNTI 氮化硅薄膜窗口本身是不具备亲水性质，但是可以根据科研的需求，对其进行改造。比如等离子刻蚀、化学改造，可以让氮化硅薄膜窗口获得亲水性，更有利于实验应用。

6、实用性

对含碳样品提供更准确的成分分析，减少污染发生，自身也不会成为污染源，增强分析的准确性。适合做为胶体、气凝胶、有机材料和纳米颗粒等的表征实验载体。也是生物和湿细胞样本的理想载体。并且存在很多潜在的应用。

7、稳定性

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氮化硅支持膜的机械稳定性可使其同时进行 TEM、SEM、EDX、XPS、AFM 等多种分析。许多研究纳米微粒，特别是含氮纳米微粒的人员发现此种薄膜窗格在他们实验中不可缺少。SHNTI 氮化硅薄膜窗口的应用

1、用于软 X-Ray 时，可以用两片氮化硅薄膜窗口将样品（含水或者挥发气氛）夹在中间，进行真空胶封，不至于让样品破坏实验的真空腔体环境，并能够得到良好的实验结果。



左图为承载固体样品（环境颗粒物/材料粉末/溶液分散/生物切片/细胞等等）的氮化硅窗；右图为采用氮化硅窗对贴+真空胶密封的液态原位样品。二者均可在超高真空中使用。



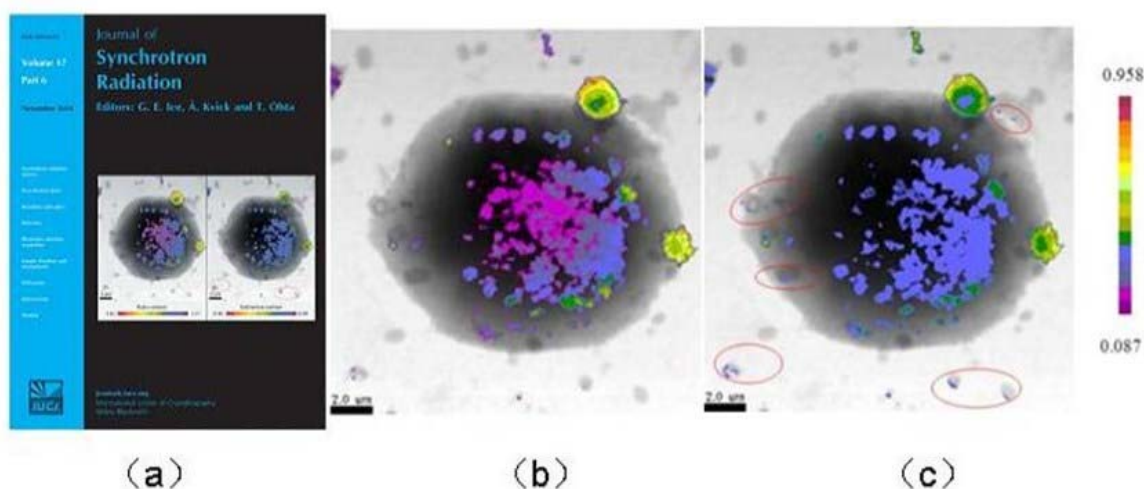
2、用于细胞生物研究时，可以将细胞直接培养在亲水化处理后的氮化硅薄膜窗口上，或者固化在氮化硅薄膜窗口上，再在仪器下研究细胞形态，体征等，甚至是活细胞。

3、作为真空设备的观察窗口。氮化硅薄膜真空适应 1 个大气压，加上其优良的透光性，在一定角度上可以无损观察真空腔体内情况。

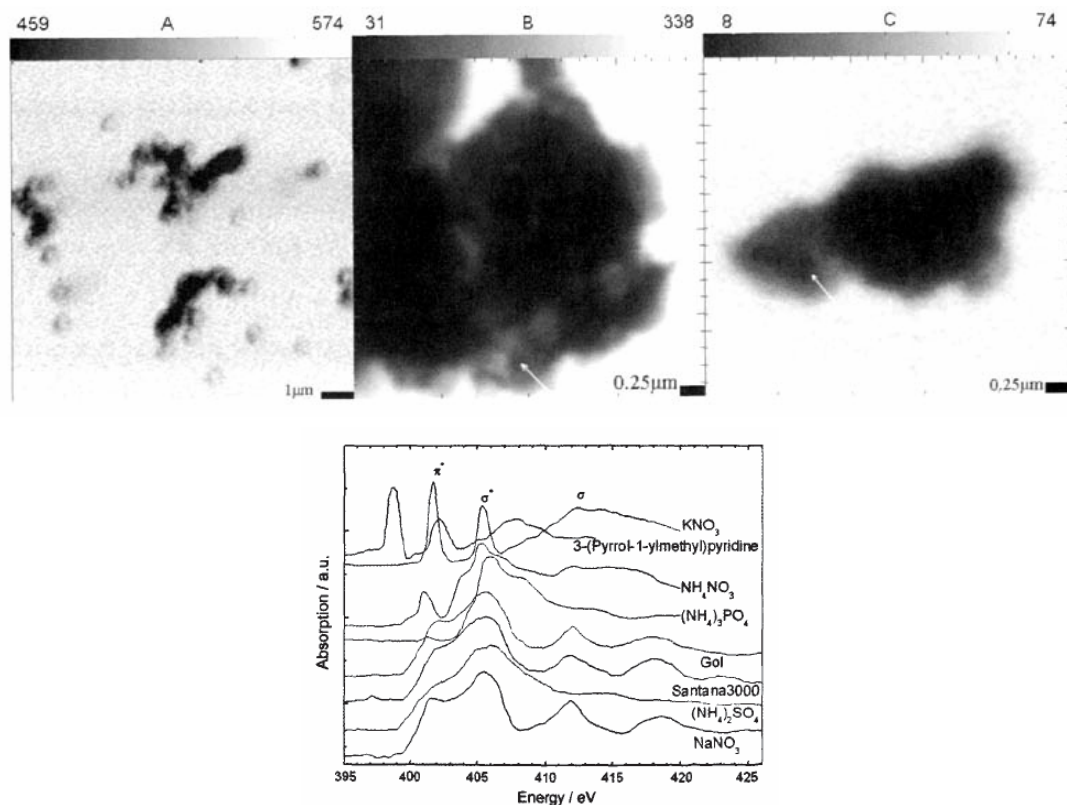
4、新型材料直接蒸发在氮化硅薄膜上，再做后续的表征、分析测试等，避免了重复制样的繁琐及样品的损失。

5、适合化学沉积和生长，研发新型材料。

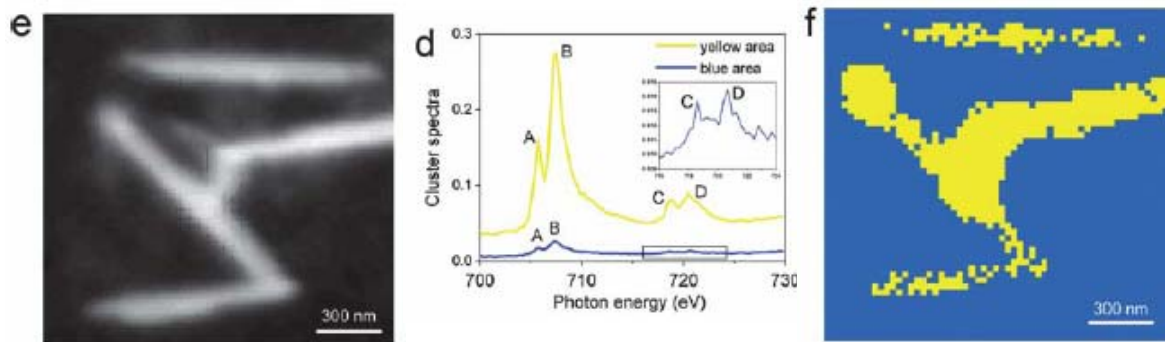
应用示例：



上海光源-软 X 射线谱学显微实验站的扫描显微成像与元素分布分析方法，该方法使用 100nm 厚度的 Si₃N₄ 窗作为样品载体，保证了样品的有效附着、平整性以及 X 光的高基底透过率。上图为该实验站成果之一，被同步辐射领域著名国际期刊 Journal of Synchrotron Radiation 刊登为封面文章的成果：相比双能衬度法和传统分析法得到的四氧化三铁纳米颗粒在宫颈癌细胞中的分布。



上海光源-软 X 射线谱学显微实验站的扫描显微成像及谱学研究-汽车尾气颗粒物的 X 射线显微形貌与谱学研究。发表在 *Nuclear Science and*



上海光源-软 X 射线谱学显微实验站的扫描显微成像及谱学研究-二维纤铁矿纳米结构单层石墨烯的高效催化降解特性研究，发表在著名期刊 *Energy Environ. Sci.*, **4**, 2035,(2011)

The Silicon Nitride film window of SHNTI is the most cost-effective products, its applications is very wide. It could use for analysis like TEM、X-Ray、SEM and so on.

It can completely avoid the background of carbon when it be used at TEM analysis.

Silicon nitride film window used in the X-Ray can be achieved maximum transmission rate of soft X-ray (such as vacuum ultraviolet). The softer X-ray, the lower energy , the worse penetrating it could have, so that it required thinner silicon nitride window. Especially in the "off-axis" work module (i.e. film and beam at a certain angle),we also need thinner film window, and better X-Ray penetration.

Silicon nitride film window as a durable substrate used in the SEM .First observed in the TEM, And then in the same area under the SEM to match, and also be used in AFM compared with their TEM images.

Commonly measurement of existing technology or ST Silicon nitride film, although it has a high residual stress to the ST film, they are not strong enough, and easy to break. Based on the needs of X-ray microscopy and transmission imaging, Silicon nitride film on the soft X-ray must satisfy the smaller absorption. The Silicon nitride film windows supplied by SHNTI are low stress load tools (also available as mini-dish, support film), that improved the shortcomings of the original technology.

Characteristics Silicon nitride film windows of SHNTI:

1、 The transmittance

Sometimes we mention that window film has light performance, which can "see through" at visually. For example , in light microscope, light transmittance will be reduced when the thickness of film over a certain level. In estimating the transmission performance of the film, the absorption line should be noticed, if it's necessary to consider the optical properties, absorption limit should be lower than 13nm. When the absorption limit is 13nm,100nm thick film transmittance is 44%; When the absorption limit is 2.4nm, the light transmission decline to 13%.

2、 Flatness

Silicon nitride film window film is smooth, strength, density is good, very stable surface smoothness (roughness less than 1nm). Normally there's no negative effect for the application. We can see that the surface of silicon nitride thin film situation by the AFM testing.

3、 Temperature

The products can be used in high temperature areas, it is able to withstand 1000 degree centigrade heating, It's very suitable for the surface of a silicon wafer substrates grown by CVD using a variety of nano-materials. Silicon nitride itself is a super hard material, with lubrication, and wear resistance, it's a kind of atomic crystal, Anti-oxidation at the high temperature. And it is also resistant to thermal shock, the air heated to above 1 000°C, and then rapidly cooling rapidly heating, it will not shatter.

4、 chemically inert

No reaction with other inorganic acids , except HF.

5、 Hydrophilic

SHNTI silicon nitride film window does not have the hydrophilic nature itself, but according to the needs of scientific research, it could be transformed. Such as plasma etching, chemical transformation, the silicon nitride film window can be hydrophilic, ,more convenient to experimental applications.

6、 practicality

SHNTI Silicon nitride film provide more accurate composition analysis to the samples of carbon included, reduce the contamination occurred, and themselves will not become a source of pollution, enhance the accuracy of the analysis. It is suitable to act as a carrier of colloid, aerogels, organic materials and experimental characterization of nanoparticles. But also can be used for the ideal carrier of biological and wet cell samples. And there are many potential applications.

7、 Stability

Mechanical stability of silicon nitride support membrane allows it have TEM/SEM/EDX/XPS/AFM and other analysis simultaneously. And it will also play a great role in the many research of nano-particles, in particularly, Nitrogen-containing nanoparticles researchers found that these silicon nitride films are indispensable at their experiment.

The applications of SHNTI silicon nitride film

- 1、 For soft X-ray , you can use two pieces of silicon nitride film windows take the sample in the middle(which samples have water or volatile atmosphere),plastic vacuum sealed, so that it will not allow destruction of the experimental sample vacuum chamber environment , and you can get good experimental results.
 - 2、 When the silicon nitride film window is used for cell biological studies, directly to cultured cells can be treated in the hydrophilic silicon nitride film on the window, or curing the silicon nitride window, then you can study the cell morphology and signs under the instruments, even lives cells.
 - 3、 The observation window as a vacuum device. Silicon nitride film adapt a vacuum atmosphere, coupled with its excellent light transmission, by a certain point of observation it can be non-destructive vacuum chamber interior situation.
 - 4、 Direct evaporation of new materials on the silicon nitride film, then do characterization, analysis and testing, to avoid the kind of tedious re-replication and sample loss.
- Suitable for chemical deposition and growth, and develop new materials.

标准氮化硅薄膜规格（基底厚度 525um 或 200um）:

Standard silicon nitride film window specifications (substrate thickness of 525um or 200um)

- 1、外框 5mm×5mm，窗口大小 1.5mm×1.5mm，膜厚 50/100/150/200nm
 Frame 5mm×5mm, window size 1.5mm×1.5mm, thickness 50/100/150/200nm
- 2、外框 7.5mm×7.5mm，窗口大小 3mm×3mm，膜厚 50/100/150/200nm
 Frame 7.5mm×7.5mm, window size 3mm×3mm, thickness 50/100/150/200nm
- 3、外框 3mm 直径，窗口大小 0.1mm×0.1mm×9，膜厚 20/50/100nm
 Frame diameter 3mm, window size 0.1mm×0.1mm×9, thickness 20/50/100nm
- 4、外框 3mm 直径，窗口大小 1mm×1mm，膜厚 20/50/100/150nm
 Frame diameter 3mm, window size 1mm×1mm, thickness 20/50/100/150nm
- 5、外框 3mm 直径，窗口大小 0.1mm×1.5mm×2，膜厚 20/50/100nm
 Frame diameter 3mm, window size 0.1mm×1.5mm×2, thickness 20/50/100nm

非标准氮化硅薄膜窗口接受客户要求定制，但是订购量多，价格会降低。（一般建议 100 片以上订购，平均单价会比较低。）

For non-standard silicon nitride film window, we can accept customized requirements, and the price will be reduced if the order quantity is big (Generally suggestion, more than 100 pieces, the average unit price will be lower.)

SHNTI silicon nitride film window products are fully specified by 4 parameters: window area (B), frame thickness (D), film thickness (A) and frame diameter (C):

