

# Irradiation effects on structure and spectroscopic properties of sugar doped sol-gel silica

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## Abstract

So, the aim of the present research is :

- the synthesis of new matrix silica xerogels by incorporating sugar as an organic doping
- the investigation of gamma irradiation effects on the structural and optical properties of sugar silica xerogels.

## Materials and methods

### Materials

Samples of silica were made by mixing tetraethylorthosilicate (TEOS) and ethanol. Next, HCl and NH OH were respectively added as hydrolysis and condensation catalyst.

### Irradiation

All samples were irradiated with <sup>60</sup>Co source at a dose rate of 6 Gy/min.

### Instrumentation and procedures

The FTIR analyses have been acquired using the KBr pellet technique with a Magna-IR-560 apparatus.

The absorption measurements have been carried out with a Shimadzu 1800 UV-Visible Spectrophotometer.

## Results and Discussions

### 1- Aging of hybrid sucrose/xerogels network

Fig.1 shows the formation of siloxanes bands with free water molecules, in the range of [ 0-60] kGy, indicating that the irradiation process acts as a catalyst promoting the polycondensation reaction. Above 60 kGy, the intensity diminution is attributed to scissioning of siloxane bond.

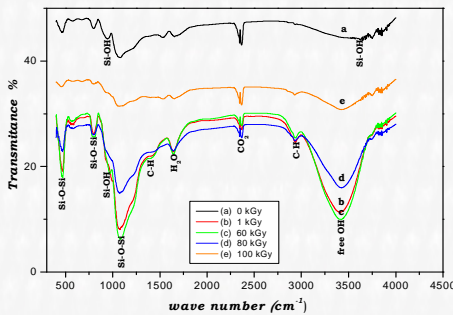


Fig.1 FTIR spectrum of sucrose silica xerogels

Above 60 kGy, the intensity diminution is attributed to scissioning of siloxane bond:



### 2- UV-Visible absorption spectra

The UV-Vis spectra of the pristine sucrose silica xerogels exhibits a shoulders at around 4,5 eV and 5,4 eV attributed to carbonyls radicals and oxygen deficient centers (ODCs) respectively (fig.2).

The gaussian fit of overlapped bands (Fig.3), reveals three major absorption UV bands corresponding to cacrbonyl radicals, NBOHC and E' center.

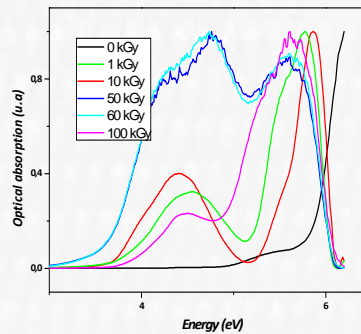


Fig.2 Optical absorption spectrum

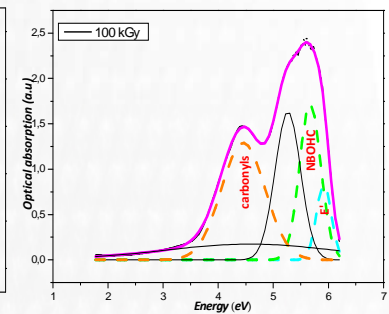


Fig.3 Gaussian fit of UV-Vis spectrum

The NBOHC and E' are generally resulted from the scission of Si-O-Si bond.

The carbonyl radical is derives from sucrose compound.

### 3- Optical energy gap

The noticeable decrease in the optical energy gap from 4,9 eV for pristine samples to 3,6 eV for those irradiated, can mainly attributed to the creation of carbonyls level band in the gap.

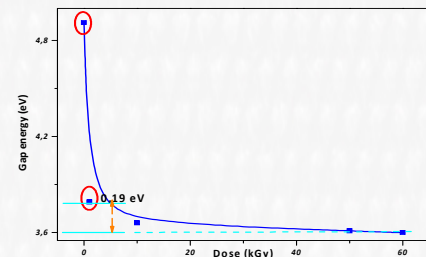


Fig.4 Gap energy variation with different dose irradiation.

## Conclusions

- Gamma rays induce defects NBOHC, E' center and carbonyl radicals in hybrid sucrose/ xerogels.
- The irradiation process acts as a catalyst promoting the polycondensation reaction.