In the case of $^{80}Se(n,\alpha)^{77m}$ Ge reaction cross-section, the present work offers first Ge(Li) measurement with a definite value. Though Venugopala Rao and Fink[4] tried this reaction with a Ge(Li) detector, they gave only a limit to the cross-section as 2-9 mb. The present value of the cross-section for the reaction $^{78}Se(n,\alpha)^{75}Ge$ is smaller than the only Ge(Li) value reported earlier[4], while for the reaction $^{68}Zn(n,p)^{68m}$ Cu, the present value is more than that of the only earlier measurement[7]. In the latter case, the difference might be due to the self absorption of 84 keV gamma ray within the sample. In our measurement, the relative efficiency of the detector, corrected for self absorption and scattering within the sample, was calibrated using the simulation technique. In the case of $^{66}Zn(n,p)^{66}Cu$, the present cross-section value is in agreement, within the limits of error, with the earlier measurement[13] using Ge(Li) detector giving a value of 65 ± 6 mb.

NLD is thankful to the University Grants Commission for fellowship.

16 February 1982

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STUDY OF ESCA AND AUGER CHEMICAL SHIFTS IN SOME GALLIUM COMPOUNDS

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The pioneering work of Siegbahn and his co-workers[1] in the field of x-ray photoelectron spectroscopy (XPS) has resulted in a technique having a variety of applications. One of the most important applications of this technique, widely referred to as ESCA (electron spectroscopy for chemical analysis), is the determination of the so-called chemical shift in the core electron binding energy (BE). The BE of a core electron of free atom is different from that when it is a part of a molecule. Thus ESCA not only provides a rapid elemental analysis of a specimen, but also tells in what chemical form a particular element is present.

ESCA Chemical shift in GaP

The ESCA chemical shift of $Ga2p_{3/2}$ core level in gallium phosphide with reference to Ga_2O_3 is not listed in literature. Therefore, we have attempted the present study. A small piece of GaP specimen, approximately 5 mm × 5 mm and 1 mm thick, was exposed to atmosphere for a few hours so that a layer of Ga_2O_3 was formed on GaP surface. The electron spectrometer employed is the Physical Electronics Industries Model 550 ESCA/Auger spectrometer. It has a double pass cylindrical mirror analyser for the energy analysis of the electrons. Using Mg K α ($h\nu = 1253.6$ eV) x-rays (power = 400 W) the photoelectron spectrum in the BE range, 1110-1130 eV was scanned. Two peaks were seen corresponding to $Ga2p_{3/2}$ core electrons. On the basis of electronegativity, we could assign the peak at higher BE to $Ga2p_{3/2}$ core level from Ga_2O_3 while the peak at lower BE to the same core level from GaP. The electronegativity of oxygen is more than that of phosphorus. Further confirmation was obtained by running the ESCA spectrum of a pure Ga_2O_3 specimen. The BE's of the two peaks are 1124.1 eV and 1121.4 eV and the difference which is equal to 2.7 eV is the chemical shift of $Ga2p_{3/2}$ from GaP w.r.t. Ga_2O_3.

Auger Chemical Shift in Ga_2O_3

Auger lines also show chemical shift corresponding to different species of an element[1,2]. Often the chemi-

cal shifts of Auger lines are of much larger magnitude than that of core electron lines for a particular system[3]. It is, therefore, advantageous to measure the Auger chemical shift in cases where the ESCA chemical shift is not appreciable. The Ga metal-oxide system is one such example where the shift of Ga $2p_{3/2}$ core level from oxide w.r.t. the metal[3] is less than 1 eV. A drop of gallium metal exposed to air was spread on an Al-metal foil coated with adhesive. The ESCA spectrum in the BE range, 1110–1130 eV was obtained. There was only a single peak of Ga $2p_{3/2}$ with BE value that corresponds to gallium oxide. However, the asymmetry of the peak indicated that there might be another peak on the lower BE side of the observed peak. Next, we recorded the spectrum in the BE range, 180-200 eV, in order to obtain the most intense Auger line $L_3M_{4,5}M_{4,5}$ of gallium. The spectrum showed two peaks at energies 184.6 eV and 190.2 eV. Both are Auger lines pertaining to $L_3M_{4,5}M_{4,5}$ transition. The line at lower BE could be assigned to Ga-metal while that at higher BE to Ga_2O_3. The energy difference between these two peaks is seen to be 5.6 eV which is the Auger chemical shift of Ga_2O_3 w.r.t. Ga-metal. Therefore it is advantageous to determine the Auger chemical shift for systems that do not have adequate ESCA chemical shifts.

13 October 1981

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MUTATION INDUCTION BY BENOMYL IN *SACCHAROMYCES CEREVISIAE*

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Benomyl (methyl 1, butyl carbamyl benzimadazole 2-carbamate) is a systemic fungicide with a wide range of antifungal activity. There are reports of this chemical as a mutagen in *Escherichia coli, Salmonella typhimurium* and *Fusarium oxysporum* and induces gene conversion in yeast and in *Neurospora crassa*[1-4]. In this communication, we report that benomyl is a strong mutagen in yeast *Saccharomyces cerevisiae*, only under growing conditions and does not cause inactivation or mutation in resting cells.

S. cerevisiae 2180-1 A a g^+ was from the yeast stock centre, University of California, Berkeley, California and was maintained on YEPD agar slants (yeast extract, 0.5%, peptone 1%, dextrose 2% and agar 2%). Benomyl (Benlate, 99% WP) was a gift from M/s DuPont, USA. To test if benomyl is mutagenic in yeast, cells were suspended in either synthetic growth medium (yeast nitrogen base 0.67% and glucose 2%) or in phosphate buffer (pH 7.0, 0.1 M) containing 10 μg/ml of benomyl and incubated at 30° C on a rotary shaker. At intervals 0.1 ml of the sample was withdrawn and diluted with distilled sterile water and plated on YEPD agar plates and incubated at 30° C for 72 hr. After determining the number of survivors, the plates were overlayered with 1% agar containing 0.1% tetrazolium hydrochloride to detect the number of petite mutants[5].

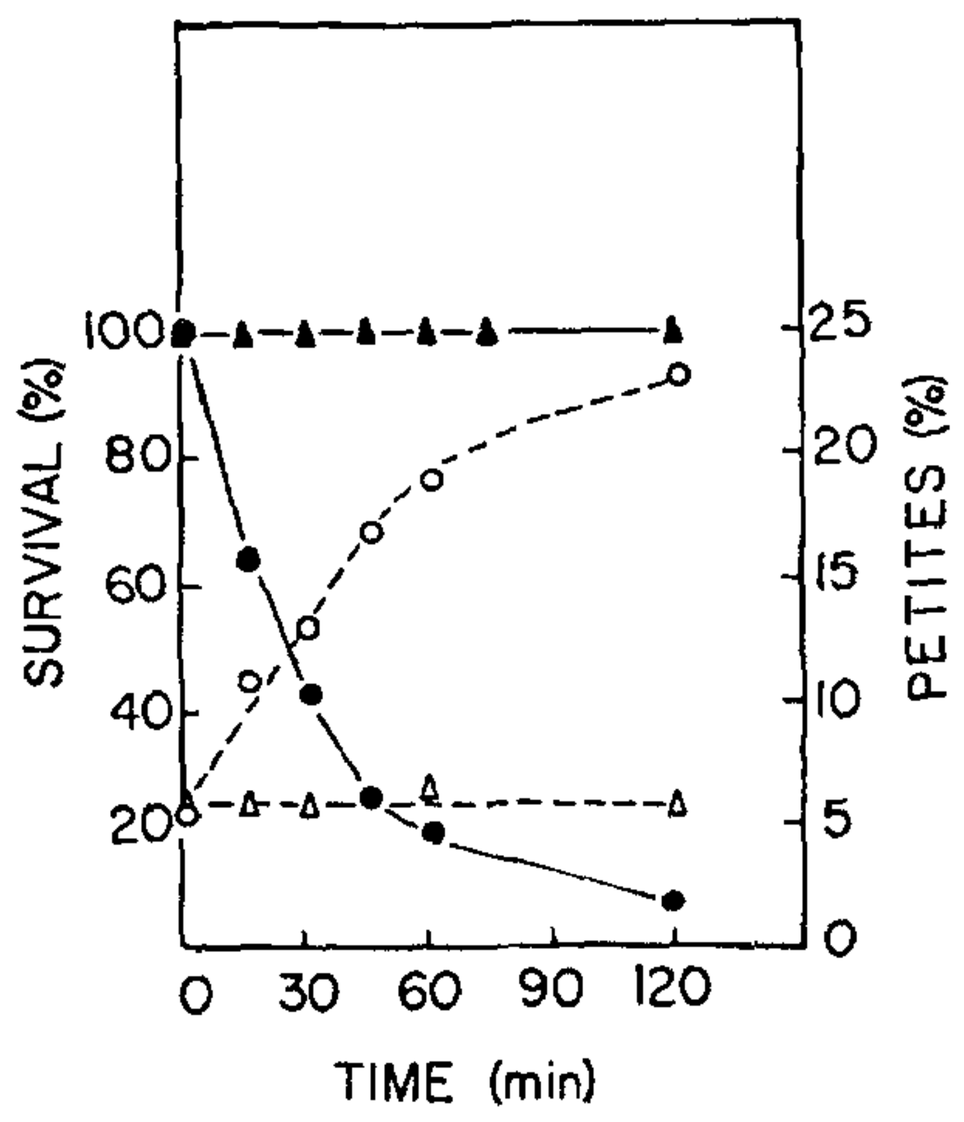

Figure 1. Effect of benomyl on induction of petite mutation. △, Percentage of survival petites in phosphate buffer (pH 7.0, 0.1 M). ○, Percentage of survival petites in synthetic growth medium. ▲ Percentage of survival in phosphate buffer (pH 7.0, 0.1 M). ● Percentage of survival synthetic growth medium. The concentration of benomyl was 10 μg/ml.

The number of survivors when treated with benomyl either in phosphate buffer or in growth medium (for 120 min) is shown in figure 1. Benomyl does not inactivate the resting yeast cells but strongly inactivates cells suspended in the growth medium. However, no growth occurs during the 120 min of