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HIGHLIGHTS OF THE FIFTEENTH INTERNATIONAL CONFERENCE ON PARTICLE TRACKS IN SOLIDS

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The era of solid state nuclear track detectors (SSNTDs) began in 1960's when charged particle tracks were revealed by chemical etching by trio of Fleischer, Price and Walker at GEC Laboratory, Schenectady, USA. The potential applications of this simple technique were soon realised and exploited in diverse fields, viz geochronology, nuclear physics, space physics, reactor physics, nuclear biology, radiation dosimetry and exploration geophysics. SSNTDs are the cheapest, reliable and rugged detectors developed so far. A variety of commonly available materials can serve as SSNTD after proper calibration. Surprisingly, all natural minerals, glasses and plastics have been used as a charged particle detector. Even window glass of your office and plastic cover of your book can serve as an SSNTD.

According to a recent study by R.L. Fleischer (GEC Report No. 90 CRD 212 November 1990) the total number of publications in the field of SSNTDs is 3000 and the average rate of production is 280 ± 60 papers per year. The technique has reached its plateau (Fig.1) after the Lyon Conference in 1979 except for two areas of application, viz personnel dosimetry and radon monitoring.

Track formation, development and observation is still an attractive theme for trackologists. SSNTD applications in space research, nuclear physics and fission track dating are showing a downward trend. However, annealing studies of fossil tracks have gained some momentum due to unique applications in tectonic uplift and hydrocarbon exploration. An emerging area of particle track application is in the domain of materials research.

The 15th International Conference on Particle Tracks in Solids was organised by the International Track Society in collaboration with International Atomic Energy Agency (IAEA) at Marburg in Germany during 3-7 September 1990. It was sponsored by International Centre for Theoretical Physics (ICTP), Trieste, Italy and the Council of Europe, Strasbourg, Germany. The Marburg event proved to be the biggest show in

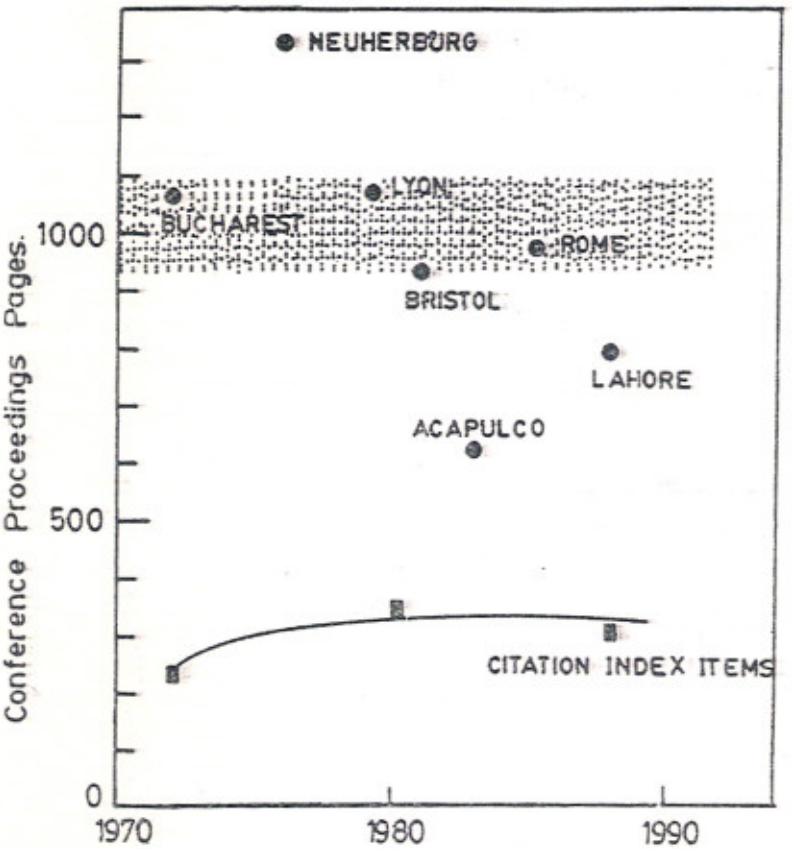

Figure 1. Publication of papers in the field of SSNTD.

the history of international SSNTD conferences. A record number of abstracts (320) were contributed by delegates from a record number of countries (40) which participated in this Conference. The effect of 'Perestroika' was visible at this Conference as a large contingent of delegates from Soviet Union and other East European countries participated, perhaps, for the first time. The organisere (Prof (Dr) R Brandt and his team) had made elaborate arrangements to receive the delegates and to make their stay comfortable. The beautiful town of Marburg on Lahn hosted this International Conference and delegates had a feast of rich cultured heritage of this famous University town which is considered to be the centre of Europe.

The Conference started on 3rd September with keynote addresses by Dr Robert Fleischer (USA) and Professor E Shopper (Germany). Due to large number of papers contributed at this Conference, parallel sessions were organised both in the morning and evening on all days. Except for invited talks, majority of the papers were presented in poster sessions. Since the organisers had announced prizes for the best poster, this

had a catalytic effect and the posters were of very high quality. Despite the paucity of time, the poster sessions were well attended and group discussions were held on some of the interesting ones.

Theme-wise classification of papers is given in Table 1. There was a large number of papers on the theme 'Track Formation, Development and Track Observation'. The enigma of particle tracks in solids has so far defied solution. Some bold attempts were made by Professors Groenveld (Frankfurt) and L.T. Chadderton (Canberra) to understand electron energy deposition in solids and formation of charged particle tracks. Professor Chadderton introduced the concept 'ridging' and 'bridging' to explain the anomalous ranges of xenon ions in muscovite mica. A noval technique of electron and other light charge particle track formation in natural mica was introduced by Dr Russel (UK). Muscovite mica books with fossil records of track events generated a lot of interest among the delegates. How the electron showers (jets) were recorded in natural mica occuring as pegmatites in underground mines is a mystery of nature yet to be probed convincingly.

Table 1. Classification of papers*

Theme	Papers presented	Poster session	Total
Track formation, development and observation	33	59	92
Radon studies	16	41	57
Nuclear physics	15	25	40
Neutron dosimetry	6	32	38
Space research and geoscience	14	16	30
Life science and radiography	6	10	16
Filters and other applications	5	10	15
Heavy ion materials research	5	27	32

* Total number of abstracts received = 320

About a dozen papers dealt with track observation using automatic scanning devices. The reliability of the system has improved over the years and most of the drudgery of track counting using optical microscopes can be avoided. Unfortunately, we have not developed any system so far in India.

Recent developments to understand track formation in solids rely on electron microscopy. Radiation damage zones or latent tracks have been studied directly under high resolution transmission electron microscopy by a French group at the University of Caen and the GSI team of Reimer Spohr and J. Vetter. Heavy ion tracks have been observed in metal alloys by the French group.

Radon investigations have occupied a centre stage in SSNTD research. 57 papers were contributed on this theme. Radon studies pertained to measurement of emanation rates both indoors and outdoors of dwellings, in building materials, near power stations,

in soil gas and groundwater for prediction of seismic events and for location of oil and gas deposits in Turkmenia. Radon has emerged as the predominant source of environmental pollution and its health hazard effects on general population and miners is of special interest to health physicists all over the world.

Nuclear physics (40) and neutron dosimetry (38) were the other attractive themes for participants. Major contributions were made by research groups of JINR, Dubna (K.D. Tolstov and S.P Tretyakova), Marburg (R. Brandt, *et al*) and Strassburg (M. Debeauvais *et al*). In addition to detection and identification of heavy ion induced nuclear reaction products using SSNTDs, some interesting but inconclusive results were reported on cold fusion and anomalon production experiments. The applications of plastic SSNTDs (CR-39 and LR-115) for thermal and fast neutron dosimetry at nuclear power plants was highlighted. Neutron spectrum measurements and fluence determination, use of bubble detectors for monitoring neutron emission from spent reactor fuel and use of electrochemical etching for neutron personal dosimeters were some of the other themes of interest.

There were 30 papers in the area of space research and geoscience. Investigions of solar flare tracks in interplanetary dust particles (IDPs), ultra heavy cosmic ray experiment (UHCRE), isotopic composition of cosmic rays with ALICE experiment, identification of galactic cosmic ray tracks in olivine crystals from meteorites and age of Peking man site by fission track methodwere some of the other highlights in this area.

To highlight applications of SSNTD research, a special Symposium was organised at GSI, Darmstadt on the theme 'Heavy Ion Materials Research within the framework of 15th International Conference. The contributions to the Symposium opened new vistas for a wide range of potential applications of energetic heavy ion beams in industry. Particle tracks technique can be used for microstructuring of crystals, glasses and polymers, e.g., for producing high quality filters and membranes which find application in nuclear medicine and biology. High energy ion beams (MeV/n) are used for surface modification of metals, e.g., for hardending of steel and to improve the wear resistance of Ti by implantation of N ions. Heavy ion radiation effects in microelectronic devices used in space satellites are revealed by simulation studies at relativitic energies in the 100 MeV/n range. Most of these experiments have been carried out at UNILAC facility at GSI, Darmstadt and at heavy ion cyclotron laboratory (GANIL) at Cean.

It is a matter of pride that India occupied third position so far as contributions made to the 15th International Conference is concerned (Table 2). Germany occupied the top position and USSR came second. Another special feature of the Conference is that SSNTD technique has penetrated almost all the Third World countries of Asia which is obvious from Table 2. With the commissioning of heavy ion accelerators at TIFR, Bombay and NSC, New Delhi, India can march ahead in exploitation of this noval technique of particle tracks in solids.

Tables 3 and 4 provide some data on national workshops held in India and the recent international Conferences in this field.