EXECUTIVE SUMMARY

0.1 THE PRODUCT

Ceramic Capacitors (often termed cercaps) are a primary member of the family of capacitor components. Other important types of capacitors are Aluminium Electrolytic, Metallised Polyester and a half dozen more. Being the last ones to be introduced, they are made with technology quite different from the remaining types of capacitors and are heavily dependent for their excellent performance on the improved dielectric material used in their construction.

0.2 MANUFACTURING PROCESS

The manufacturing process is in principle similar to the traditional ceramicware process. However, as befits the ever-miniaturizing electronics industry, the process is extremely refined, sophisticated, controlled and automated. Formulation of dielectric ceramic, to give the right combination of electronic properties, is a technique in itself; with certain selected compounds which are powdered microfine, intimately mixed, calcined and further ground to micron sizes. This part of the process is often separately undertaken (except for the very large cercaps manufacturers) by sepecialist firms who provide standardized dielectric material to the cercap industry in general.

The powders are then mixed with special binders according to the shape that the final capacitor has to take. This body may be pressed or extruded or calendared or slip-cast to precise dimensions required for further processing. Screen-printing of the capacitor electrodes is an automated process, so that millions of pieces can be mass produced. Controlled firing at 1000-1200 centigrade firms up the capacitor shape and enables connecting wires to be attached and soldered. The many variations and parameters of this technique are thoroughly discussed in the text.

As cercaps have improved from simple single-layer disks to a complex multi-layered micro-electronic structure, the machinery to execute the process has been improved and innovated to the nth degree. Thus a single line to produce disk capacitors which may need about half million dollars of imported plant has

graduated into a plant for automatically producing multi-layer ceramic capacitors (MLCC) costing between two to three million dollars. Abundant details are provided in the body of the report.

0.3 HISTORICAL DEVELOPMENTS

Indian cercap industry started in the 60's with a major effort over many years by National Physical Laboratory (NPL), Delhi, to locally establish a complete process from local raw materials, for simple pressed disk cercaps. As explained in the report, this effort was the seed from which the Indian cercap industry grew. Even today, a few small manufacturers use the basic process started at NPL for supplying certain niche markets.

The NPL process, however, was not further developed (with corresponding special machinery) to tackle mass production of ever improving cercaps. The industry turned to imported techniques and machines. The first three full collaborations were with CSF-Thomson, Philips, AVX. Of these three, only Philips (now Peico) has continued and sustained its production till now.

0.4 SINGLE LAYER CERCAPS

Around 1985, a spate of permissions for manufacture of single-layer cercaps were granted. This had resulted from the special encouragements announced for the components industry and the start of the boom in colour TV. The parties who implemented these permissions, however, preferred to tie up with equipment and plant designers rather than with cercap manufacturing units. Presently dominant among these units are Borar Electronics Ltd., Mandideep, M.P. and JBS Capacitors Ltd., Bhubaneshwar, Orissa as large producers of single layer cercaps.

All other aspirants to the single-layer cercap business (except some small niche-market operators) have given up mass production of single-layer cercaps due to a number of reasons which are dealt at length in the text. The fundamental reason is that these units were unable to rapidly build up production and sales to a sufficient level to be competitive with imported cercaps which were coming in (legally or illegally) at commodity prices from Taiwan and Korea. Only the three successful units mentioned above were able to do so and they are the ones who dominate in local supply at present.

0.5 MULTILAYER CERCAPS

The case of multi-layer cercaps (MLCC) is of recent origin. Two units have started production and two more are in the process of implementation. Once again collaborations (except for one unit) have been made with equipment and plant suppliers; continuity of support though the painful learning period may not be there. Meanwhile the Indian MLCC market is just developing and growing gradually. Reliance of users on imported designs will need to be penetrated by these large and capable MLCC manufacturers if they are to rapidly increase sales and improve utilization of their substantial investments to avoid financial difficulties.

0.6 DEMAND AND SUPPLY

Rapid growth of electronics (especially consumer which is a major user of cercaps) in mid eighties ran ahead of local ability to supply. In 1983, Indian suppliers could satisfy only about 70% of the market. Some of the smaller units (which may not be reporting their production) may have further enhanced local supplies. Thereafter, several of the units who had made a start seemed to fall by the wayside as detailed in Chapter 2. The supply thereafter began to dwindle.

In the expected liberalized policies, the demand from various sectors of the electronics and electrical industries is expected to grow briskly. The above situation therefore demands early action to reactivate dormant capacities in more capable hands and to put the MLCC projects on a sound footing lest imports soar in the coming years. If action is not taken, cercaps to the extent of USD 4 million (FOB @ Rs. 26 = 1 $) may need to be imported in 1995.

0.7 INTERNATIONAL SCENARIO

Worldwide, the single-layer disk cercap industry has reached a mature and stable level. The better Indian units are reasonably well up with the technology (though not in high automation) but are operating at scales substantially below units in the Pacific Rim. It should however be possible to overcome this shortcoming. Technology for MLCC however is continuing to be improved not only in materials used but also in process innovations and improved machinery. India on the other hand has just made a beginning in the MLCC area. The difficult stage of absorbing and continuously improving MLCC technology has yet to be crossed.

The two existing MLCC units have tied up with machinery suppliers (rather than MLCC makers); they will need considerable support to establish mastery of this difficult technology.

0.8 TECHNOLOGY ABSORPTION

It is important that MLCC technology be soundly absorbed because :

a. It is likely to be the capacitor technology of the future.

b. MLCC enables ultra-miniature chip components which are leading to a new method of circuit assembly SMT (Surface Mount Technology) spreading all over the world and will drastically change the Indian electronics industry also.

c. Mastery of MLCC technology enables other chip components to be taken up.

d. The same technique has been further refined to make complete circuit-blocks which is the next stage in microelectronics.

0.9 RECOMMENDATIONS

A major recommendation of this study is that the mature technology of single-layer capacitors has been reasonably absorbed in the country and should be impelled and encouraged and assisted to expand and modernize. An immediate way of doing this is for the better units to absorb and merge with some of the units that have closed down recently due to their inability to run competitively. This will avoid wasted investments, increase the scale of the merged units and put them in a position to drive back imports thus improving their economics still further due to wider markets. Government and financial institutions may assist such mergers.

In the case of MLCC, several fairly large capacities are in the process of becoming operational. In their initial stages, reasonable amount of protection should be given including encouraging Indian designers to redesign using the more modern MLCC and SMT. On their part, the MLCC manufacturers will have to make strong marketing and product applications efforts to convince customers to use their products and bring about greater efficiency and higher cost savings.

Equipment and technology exists for local formulation of dielectric material. Capabilities also exist in national laboratories to prove the use of local basic materials to formulate these dielectrics. These efforts should be brought together to result in a common set-up to locally supply all cercap manufacturers with locally formulated and steadily improving Indian dielectric material.

National laboratories should make concerted efforts to further improve dielectrics in the new "relaxor" range which is yet an innovation in the international market.

Such new material is aimed at increasing miniaturization and cost reduction as well as expanding the range of applications of cercaps.

The new "wet" technology (covered in the report) should be the next target for modernization of the existing cercap units a few years down the line. It is cautioned however that this technology is new even internationally and is substantially dependent on the excellence of the special machinery developed for the purpose.

The manufacturers currently resort to import of capital goods requirements. Automatic manufacturing lines catering to processes like wire forming, taping & soldering, testing, etc., need be developed indigenously.

The field of ceramic capacitors is at a stage where a wise handling of policy can lead to restructuring of the industry in preparation for combating imports and perhaps even exports.