

R&D STATUS REPORT

ARPA ORDER NO. 7397

PROGRAM CODE NO: 2G10

CONTRACTOR: CRYSTAL ASSOCIATES INC.
15 Industrial Park
Waldwick, NJ 07463

CONTRACT NO. NOOO14-92-C-0070

CONTRACT AMOUNT: \$600,000.

EFFECTIVE DATE OF CONTRACT: 15 APRIL 1992

EXPIRATION DATE OF CONTRACT: 14 APRIL 1994

PRINCIPAL INVESTIGATOR: G.M.Loiacono

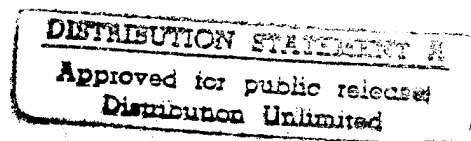
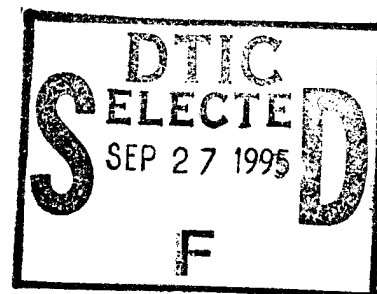
TELEPHONE NO. (201) 612-0060

SHORT TITLE OF WORK: "PREPARATION OF SINGLE DOMAIN KTA CRYSTALS"

REPORTING PERIOD: 15 OCTOBER 1993 - 31 JANUARY 1994

REPORT DATE: 2 FEBRUARY 1994

REPORT # 7



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DESCRIPTION OF PROGRESS

Run # KTA 12-05 was initiated on 29 Oct 93, using 8 seed crystals. The growth cycle was completed in 77 days. The initial saturation temperature was 895°C, and the temperature lowering range was programmed in an eight level, four segmented ramp at rates between 0.4 to 2.03°C / day. Only two pieces of spurious nucleation were observed over the run cycle. No "snow storm" type events of spontaneous nucleation were observed. We believe two factors accounted for this improved performance. First, the seed area (6189 mm²) was increased by a factor of two over Run # KTA-12-04. Second, and most important, was the observation of control problems during power failures. The 12 Liter system has a back up power supply which kicks in during any interruption in electric service (outages, brown outs etc.). However, it was noticed that during both runs KTA 12-04 and 12-05, the system set point did not return to the last ramp segment temperature. We believe this was caused by the fact that a 15 to 20 second delay is observed before full power is supplied to the furnace system from the emergency generator. During this time interval, an estimated 1 to 2°C drop in temperature is experienced. Upon, return of power, the system does not reset to the higher temperature, and the computer therefore begins lowering the temperature from the lower point. This problem has been eliminated by placing the entire computer control system on a battery back up power supply that results in a no-break, zero cross-over power transfer.

Figure 1 illustrates the crystals produced in KTA 12-05. The total yield of KTA was 1250 g (1.25 Kg), with individual crystals weighing about 170 g and averaged dimensions of (x,y,z) 30 x 50 x 70 mm. Photographs were taken of all crystals for the records. In general, all crystals were pale yellow in color (typical) for KTA and were cracked along the z axis. The cracking behavior was previously observed in the growth of KTP, and was attributed to poor growth off the seed. This occurs when the seed does not dissolve back enough prior to reaching the critical supersaturation required for growth. Refinement of the growth process technique for KTA will eliminate the cracking as experienced in our development of KTP. The next run will use the same program rate, all "y" seed plates, 25% faster rotation rate and steps will be taken to insure melt back (dissolving) on the seeds prior to growth. These parameters should result in crack-free, flawless KTA crystals. Samples cut from the boules produced will be tested.

This run demonstrated that devices with 1 x 1cm apertures and path lengths in excess of 10mm can be obtained in this growth system. Another run will be started immediately and completed by the end of this program (April '94).

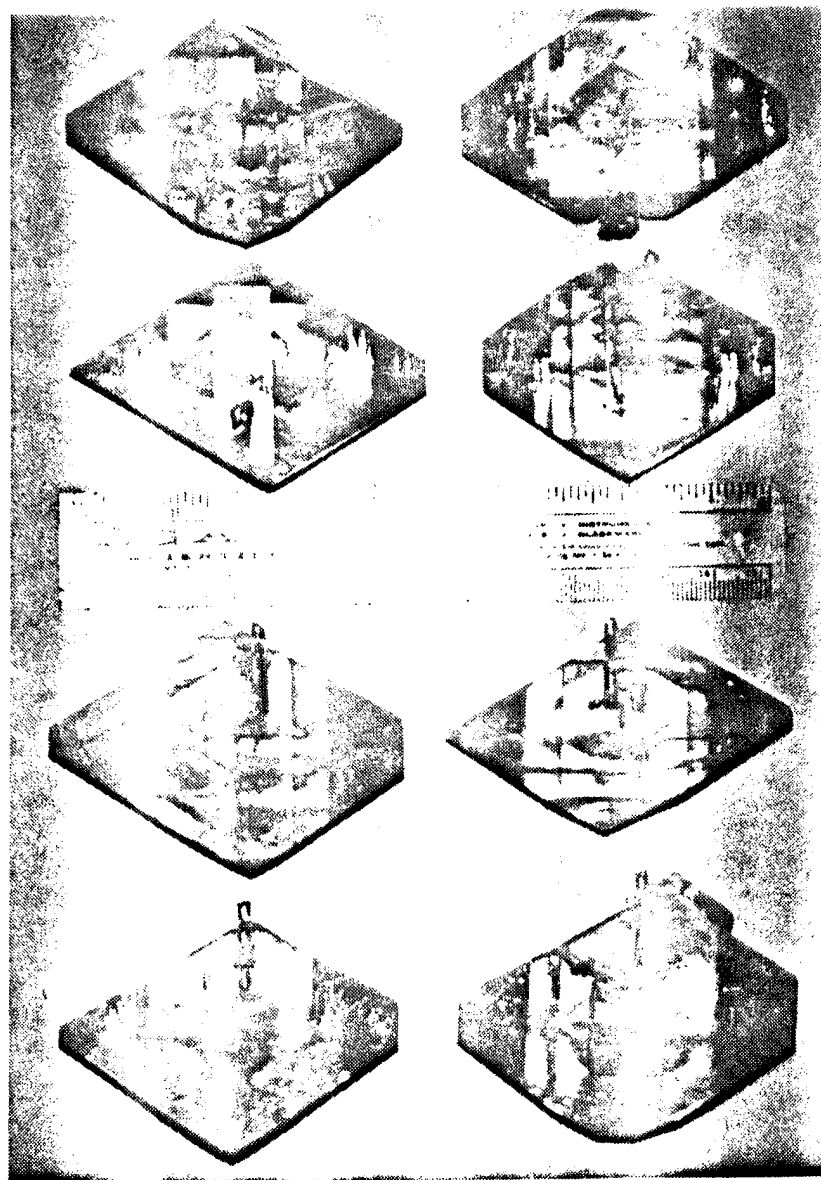


Figure 1: Crystals from Run # KTA 12-05

FISCAL STATUS:

AMOUNT CURRENTLY PROVIDED ON CONTRACT : \$ 600,000.

EXPENDITURES TO DATE : 561,910.

COMMITMENTS TO DATE : -0-

FUNDS REQUIRED TO COMPLETE WORK : 38,090.