



# MATERIALS NEWS

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## THE PRESENT EDITORIAL BOARD

To better serve our readers who may want to contact them to contribute articles, make suggestions, etc., we should like to announce that the MATERIALS NEWS Editorial Board now has the following members:

Jerry Turnbaugh	Integrated Circuit Engineering
Tom Currans	Integrated Circuit Engineering
Pete Burke	Chemical Support Lab
Ron Peterson	CRT
Bill Nelson	Component Evaluation
Paul Davidson	Electrochem

The board regrets losing the services of Don Swickard who has contributed much since the inception of MATERIALS NEWS.

## THE NEW CRT LASER

Several weeks ago, the purchase of a Nd:glass laser for use in CRT manufacturing was announced in "MATERIALS NEWS." This device has been operating since that time and we have experienced success in some of our endeavors and feel that we have a good payback on our investment.

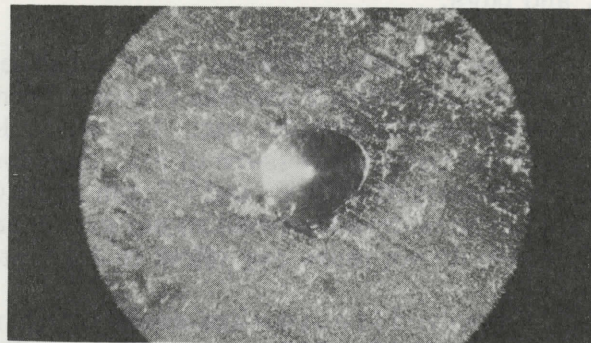
We have found that we can make .001" holes in .003" metal and it is our understanding that somewhat smaller holes can be achieved with proper optics. The laser will puncture a .075" piece of metal and in doing so makes a slightly conical hole about .010" in diameter entering and about a .005" hole leaving. Where small holes are required or where it is desirable to not touch the material being drilled, the laser is very useful. The surprising thing is that areas near the drilling site experience little temperature change.

Since a 10 - joule, 1/2 millisecond pulse (attainable with our laser) concentrated in an area .001" in diameter represents an energy density of the order of  $10^{12}$  watt/in<sup>2</sup>, material at this focus is either vaporized or plasmatized with little regard for the inertness of the material.

It is hoped that the laser will be found useful for many more applications than those now used at TEK, and, time permitting, we are quite willing to help other groups explore them.

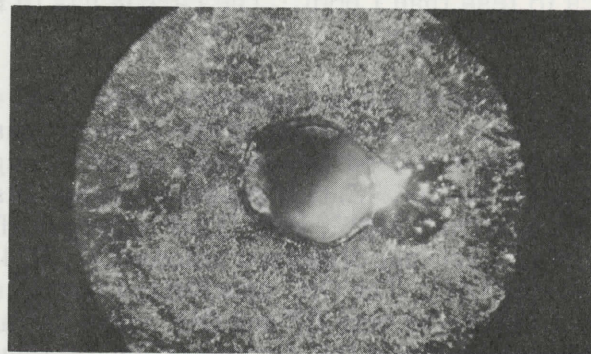
-Denton Bramwell, Ext 6311  
CRT Staff Engineering

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PHOTOMICROGRAPH 1

Four joules focussed on .065" stainless. Hole penetrates the steel, is very conical, and has an entrance about .005" diameter.



PHOTOMICROGRAPH 2

Ten joules focussed on .065" stainless. Hole penetrates the steel, is not very conical, and leaves a small quantity of slag.

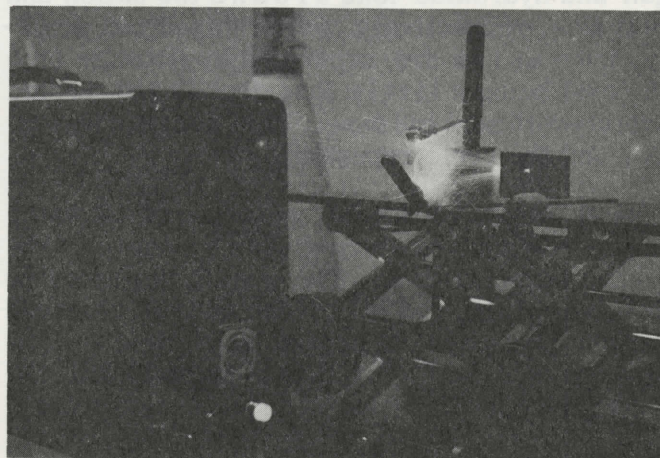


PHOTO 3

Ten joule pulse pierces .065" stainless, shooting plasma and burning steel back toward lens.

## PURIFICATION OF WATER

Water has the property of dissolving an amazing variety of chemicals. This means that when we open a tap, we get a lot more than just water. We get water containing traces of every chemical with which it has come in contact. The impurities dissolved in water can be classified in four groups: Dissolved gases, dissolved liquids, dissolved solids, and bugs.

**GASES:** Gases are present in the water because it has been in contact with air and has dissolved some oxygen, some carbon dioxide, etc. For example, water under the normal pressure of air, dissolves about 11.3 ppm oxygen at 10°C, and 7.7 ppm at 30°C. Gases are not considered harmful to our processes at TEK, so we do not make any effort to deaerate.

**LIQUIDS:** Dissolved liquids are usually organic compounds and come from the vegetation in the Bull Run watershed, from the plastic piping, or similar sources. The tap water normally contains about 5 ppm dissolved organics. Most of our DI systems have a charcoal or carbon filter to reduce organics to less than 1 ppm. The carbon has to be replaced periodically.

**SOLIDS:** Our input water contains about 30 to 40 ppm total dissolved solids, in the form of ions. These ions are removed by passing water through ion exchange resins. Cation resins exchange dissolved cations ( $\text{Na}^+$ ,  $\text{Mg}^{++}$ ,  $\text{Fe}^{+++}$ ) for hydrogen  $\text{H}^+$ . Anion resins exchange dissolved anions ( $\text{Cl}^-$ ,  $\text{SO}_4^{--}$ ) for hydroxide  $\text{OH}^-$ . The  $\text{OH}^-$  neutralizes the  $\text{H}^+$  so the concentration of both  $\text{H}^+$  and  $\text{OH}^-$  stays infinitesimally small, while the concentration of whatever other ions were present decreases.

Ion exchange resins must be periodically regenerated. To do this, the ion exchange process is reversed by increasing the concentrations of the hydrogen and hydroxide ions around the cation and anion resins, respectively. In our mixed-bed deionizers, the resins are separated by flotation (the anion resin being a little less dense) and treated separately with acid and base. They are then rinsed, mixed, and the cycle repeated.

The usual rough, but useful, measure of DI water quality is resistance, which gives a measure of the total ion concentration. The resistivity of water itself is very high, and all conductance is ascribed to the ions present. 1 ppm of NaCl gives 0.45Ω; 0.1 ppm gives 4.5 MΩ; 0.025 ppm gives 18 MΩ, the desired purity level for semiconductor technology.

**BUGS:** It may seem strange that a living organism can thrive in the dark, in water with less than one ppm organic content and less than one-tenth ppm total solids, but we have many types of organisms

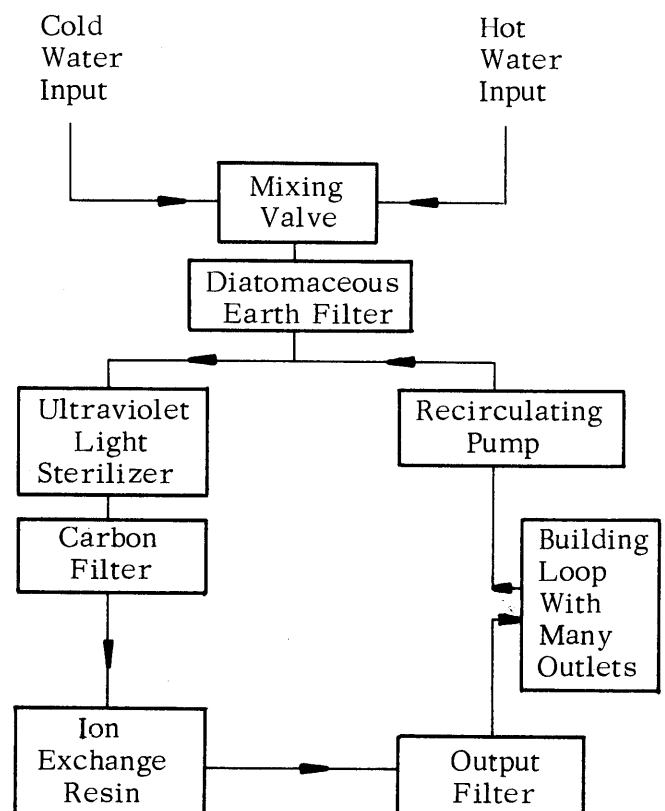
living under such conditions in our DI systems. Removing 99.9% of the bugs by chemical sterilization is possible but temporary, for the few that are missed will soon repopulate the whole system. A 0.45 micron filter will strain out all the bugs, but these filters are expensive and plug up rapidly. A simple nonspecific test we use for bugs is to push a small sample (10 ml) of water through a sterile 0.45 μ filter, add nutrient so the individual bugs grow to colonies, stain the colonies and count them.

Water is like a small boy--you can clean it up, but it is impossible to keep it clean, for anything with which it comes in contact will contribute some contamination. Water stored in stainless steel will dissolve a small but measureable amount of metal. Stored in glass, it will leach the glass. In any container, it is subject to biological growth. The only way to maintain water in a condition of high purity is to keep it moving, constantly circulating through the filters, sterilizer and deionizer, removing impurities faster than they are added.

TEK has invested large amounts of money in DI systems, and Facilities has full time personnel to maintain these systems. You can help by not wasting it. Leaving taps and tanks running when not in use usually results in overloading the treatment systems, with resultant lowered quality of the DI.

-Frazier Rohm, Ext 76  
CRT Dev. Chem. Lab  
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### A WATER PURIFICATION SYSTEM





## MAJOR SERVICES AVAILABLE IN THE CHEMICAL SUPPORT LABORATORY

Type of Service	Information Returned	Examples	Personnel to Contact	
<u>Chemical Analysis:</u>				
Elemental (Inorganic)	Major constituents	Composition of alloys, analysis of prepared mixtures, QA of purchased materials	Gene Frazier	7520 7634
	Minor constituents	Contaminats in plating baths, trace analysis for impurities	Gene Win	7520 7520
	Surface composition	Diffusion profiles, identification of microscopic contaminants	Pete Laura	7254 7846
Organic	Identification of carbon-based compounds	Cleaning compounds, plating bath additives, plastics, solvents	Rod Hal	7634 7634
<u>Structural Analysis:</u>				
Surface	Surface structure and topography, particle size and shape	Metal parts, contacts, phosphor particles, fractured surfaces, ceramic materials	Lorraine Laura	7846 7846
Subsurface	Crystal structure and imperfections, phase amounts	Silicon wafers, ceramic bodies, single crystals	Gene Dave	7520 7520
<u>Consulting:</u>				
	Chemical knowledge	Safe handling procedures, recommended solvents, materials and processes, process instrumentation and control	Any/all	
<u>Services:</u>				
Electrochemical	Custom service, procedure development	Surface preparation, plating, cleaning, electroforming	Marion Lad	7634 7520
Supplies	Non-standard chemicals	Chemicals not avaiable from Central Stores	Jane	7456

Peter Burke, Manager	7254	50/287	Laura Lusk	7846	50/287
Sharon Bolt	7456	50/287	Lorraine Mercer	7846	50/287
Rod Christiansen	7634	50/289	Lad Ouzts	7846	50/287
Harold Frame	7634	50/289	Marion Peterson	7634	50/289
Jane Guthrie	7456	50/287	Frazier Rohm	7634	50/289
Eugene Hanson	7520	50/295	Win Walker	7520	50/295
Les Keisling	7520	50/295	David Welsh	7520	50/295

### Equipment Available:

UV visible emission spectrograph; IR, UV-visible and atomic absorption spectrophotometers; X-ray fluorescence spectrometer; X-ray diffractometer and diffraction cameras; transmission electron microscopes; gas chromatograph; carbon and sulphur combustion analyzer; colorimeter; densitometer; analytical balances; pH and specific ion meters; stills; centrifuges; flash point apparatus; electroplating units; assorted laboratory glassware; chemicals and equipment.