AzTE Arizona Technology Enterprises

www.azte.com

# Direct Write Imaging Process

**AzTE Case # M01-025**


## Inventors

***Martin Mitan***

Dept. of Chemical & Materials Engineering, Center for Solid State Electronics Research, Arizona State University

***David P. Pivin, Jr.***

Dept. of Chemical & Materials Engineering, Center for Solid State Electronics Research, Arizona State University

***Terry L. Alford***

*Professor*

Dept. of Chemical & Materials Engineering, Center for Solid State Electronics Research, Arizona State University

***James W. Mayer***

Dept. of Chemical & Materials Engineering, Center for Solid State Electronics Research, Arizona State University


## Intellectual Property

**Status:** US Patent 6,750,124


## Contact

*Bill Loux*

Director of Business Development

Arizona Technology Enterprises, LLC (AzTE)

*480.884.1996 main*

*480.884.1992 desk*

*Email: bloux@azte.com*


## Background

Semiconductor devices such as MEMS, MOSFETS, CMOS, nMOS, pMOS, and BiCMOS comprise integrated circuits that perform complex and fast operations. As the dimensions of these devices continue to decrease, manufacturers must also fabricate increasingly smaller contacts in order to optimize device speeds. Specifically, these contacts require nanometer dimensions and low resistivity. As a result, manufacturers traditionally fabricate these contacts from transition metal silicides like titanium, cobalt, and nickel. Unfortunately, conventional methods of silicide fabrication require complex, lengthy, and environmentally hazardous processes.

## Invention Description

As an alternative method for silicide fabrication, ASU researchers have developed a direct-write process for forming localized metal silicides at one or more selected areas on a silicon substrate by using a focused ion beam (FIB). This process fabricates metal silicides with both low resistivity and nanometer dimensions. Consequently, the resulting silicides are particularly suitable for use in a large variety of semiconductor devices, especially those listed above, to serve as contacts, interconnects, and other related structures in integrated circuits.

## Potential Applications

As a result of the need for new methods to produce reliable silicides and to manufacture contacts in ever smaller, faster semiconductor devices, the market for the direct-write imaging process using FIB is poised to undergo rapid growth. The following provide some potential applications for this process:

- **Formation of self-aligned silicide structures directly on gate oxide films**
- **Application to other metal-silicon systems such as Ni, Pd, or Cr**
- **Introduction of necessary dopants for optimized device function**

## Benefits and Advantages

- **Low resistivity** – allows fabrication of submicron structures without use of resist-based lithography methods
- **Maskless technique**
- **Nanometer-range dimensions** – process refinement with regard to thinner initial layers, anneal time and temperature, reduced beam energy, and improved beam confinement allows improved linewidths
- **Flexibility of FIB system** – enables the study of nanostructured silicides for novel devices or mesoscopic electron transport structures.