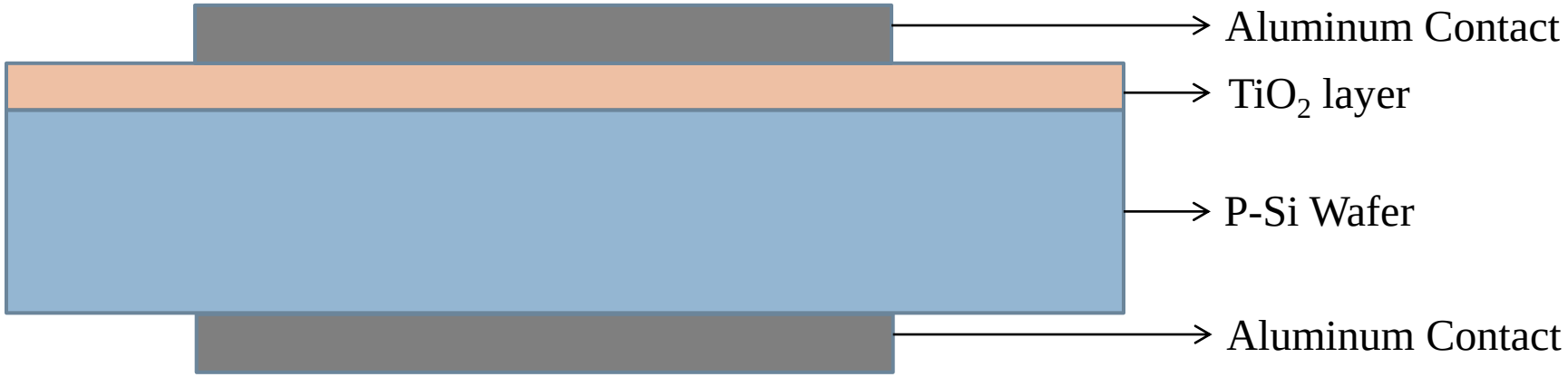
Final Device Structure:



Experiment Procedure

1. Making Sol-gel (3 step Process)

Step 1: mix TIP + Acetic acid

Place: Chemistry department

Step 2: Step 1 mixture + 1- Butanol

Place: EC lab fume hood

Finally Sol mixture of TIP : Acetic Acid : 1-Butanol (1:4:40 molar) ie (8:6.2:85.74 ml)

Step 3: Stirring sol using magnetic stirrer

Place: EC lab

2. Spin Coating TiO_2

Using spin coating technique thin layer of TiO_2 will deposited over silicon substrate

Place: Micro 1 yellow room

Future Work Spray Coating TiO2

Place: Micro 1 yellow room

3. **Annealing using CMOS specific FGA furnace**
   Process Temperature will be upto 150 ^{o}C.
   Place: Micro 1 Lab.

4. **Making Aluminum Contacts using Al thermal evaporator.**
   Place: Mico 1 lab.

5. **IV measurement**
   Place: Device/NCPRE Characterization Lab

Making Sol-gel

The Sol-gel for Titanium dioxide is made using Titanium isopropoxide precursor, Acetic acid and 1-butanol (1:4:40 molar ratio). The chemical reaction involved are as follow.

TIP: $Ti[OCH(CH_3)_2]_4$

Acetic Acid: CH_3COOH

1-Butanol: $CH_3(CH_2)_3OH$

$$CH_3COOH + CH_3(CH_2)_3OH \rightarrow CH_3CO(CH_2)_3CH_3 + H_2O$$

$$Ti[OCH(CH_3)_2]_4 + 2H_2O \rightarrow TiO2 + [HOCH(CH_3)_2]_4$$

Procedure to be followed

1. Mix TIP with Acetic acid in glove box

2. This reaction is exothermic and also TIP may get precipitate during addition thus while adding TIP to Acetic acid add it drop by drop with constant shaking.

Same procedure is used by NCPRE student (Jim John, Sonali Warade) at Chemistry department with help of Chemistry department people.

3. Take out the solution and add this in 1-Butanol

4. Using magnetic stirrer stir the solution

5. After approximately 2-4 hr sol will be ready to use

Why to store in glove box

From MSDS :

- **Precautions for safe handling :** Avoid contact with skin and eyes. Avoid inhalation of vapor or mist. Flash back possible over considerable distance. Container explosion may occur under fire conditions. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.
- **Conditions for safe storage, including any incompatibilities:** Handle under nitrogen, protect from moisture. Store under nitrogen. Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Solution on Problem:

since TIP is sensitive to moisture that's why we want to store it in glove box and the reactions taking place in later stages are not sensitive to moisture thus other steps of making solve can be done in fume hood with proper care. similar steps are done by NCPRE students in Chemistry department lab.