



Fabrication of PVDF Film Using Deep Coating Method and Characterization

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Outline Presentation



- INTRODUCTION



- EXPERIMENT



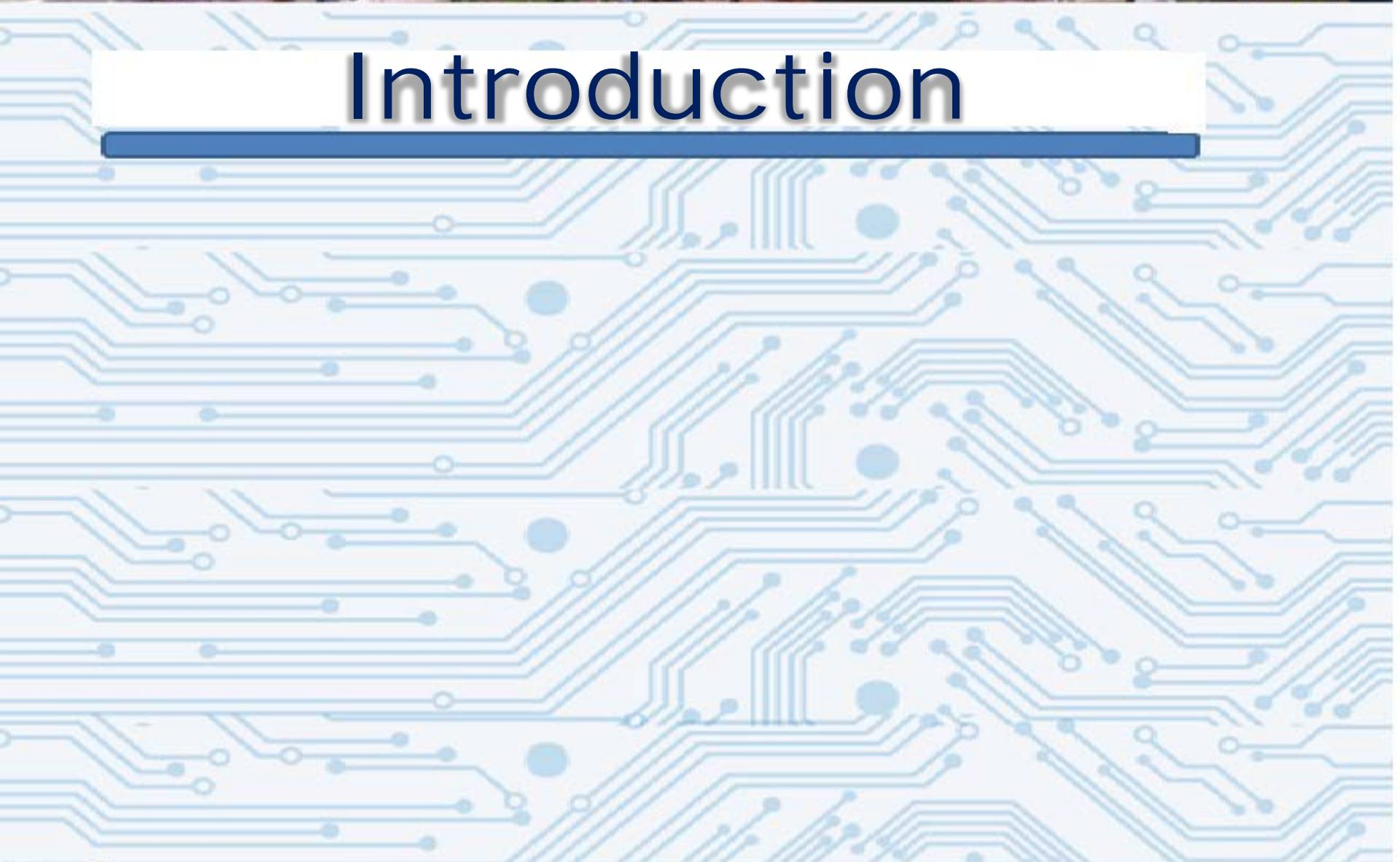
- RESULT AND DISCUSSION



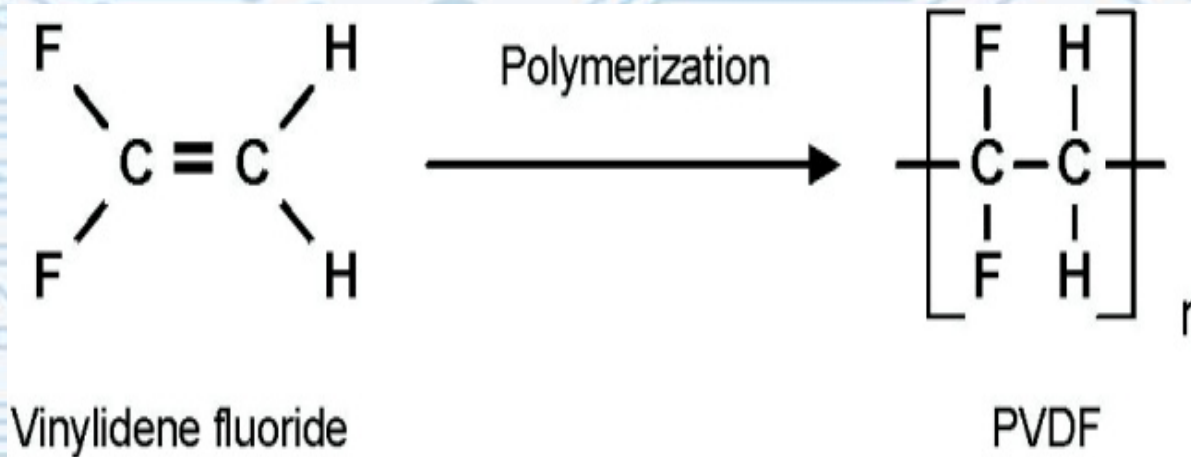
- CONCLUSION



Introduction



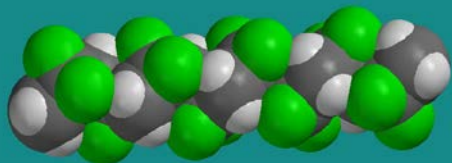
PVDF is generally produced by the free-radical polymerization of VDF monomer



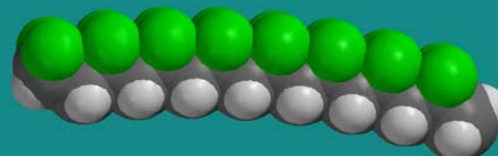
Polymerization process

Representations of the molecular structure of the vinylidene difluoride (VD) monomer and of the α and β forms of the PVDF polymer.

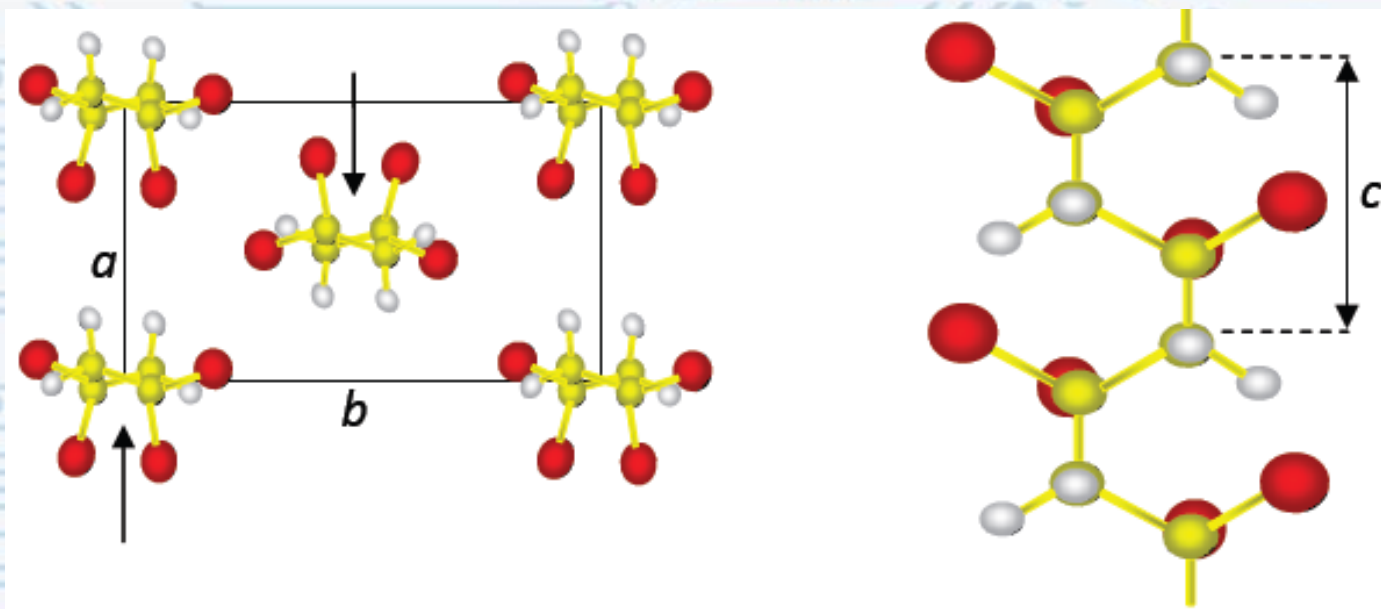
PVDF- α form



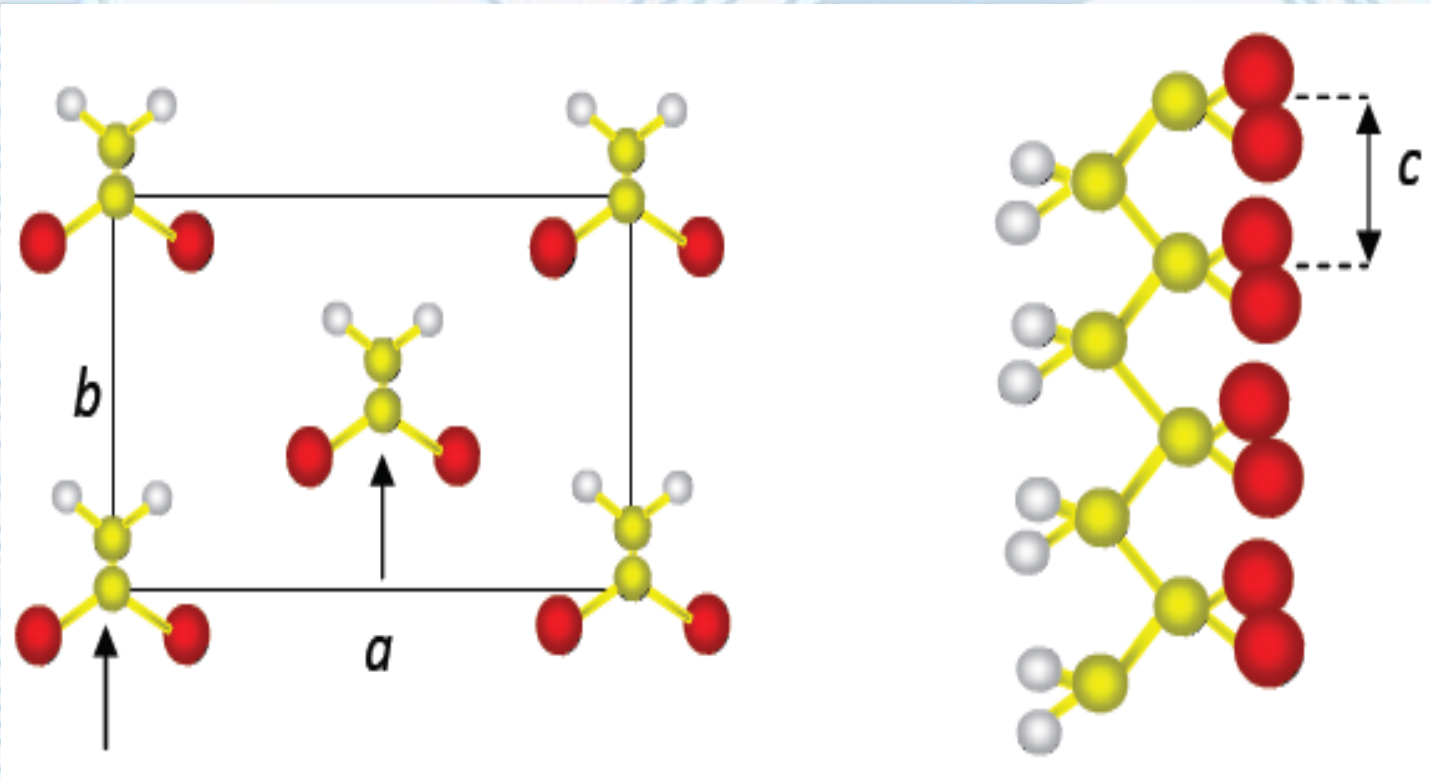
PVDF- β form



Recently, PVDF with β -phase structure are widely developed due to molecules with this structure provides the greatest piezoelectric effect compared with other phase.



Chain structure of α -phase in PVDF



Chain agglomeration of β -phase in PVDF.



Piezoelectric effects relate closely to its crystalline phase form.

Piezoelectric constant is proportionate to the increase of its β -phase in the substance

PVDF that crystallize from the melting process will then form a structure that contains α -phase.

To transform the α -phase into β -phase doing with Annealing process.



EXPERIMENT

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graph TD; A[PVDF Film Fabrication With Deep Coating Machine] --> B[Annealing]; B --> C[Characterizations (XRD, FTIR)]; C --> D[Analyzed];
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PVDF Film Fabrication
With Deep Coating
Machine

Annealing

Characterizations
(XRD, FTIR)

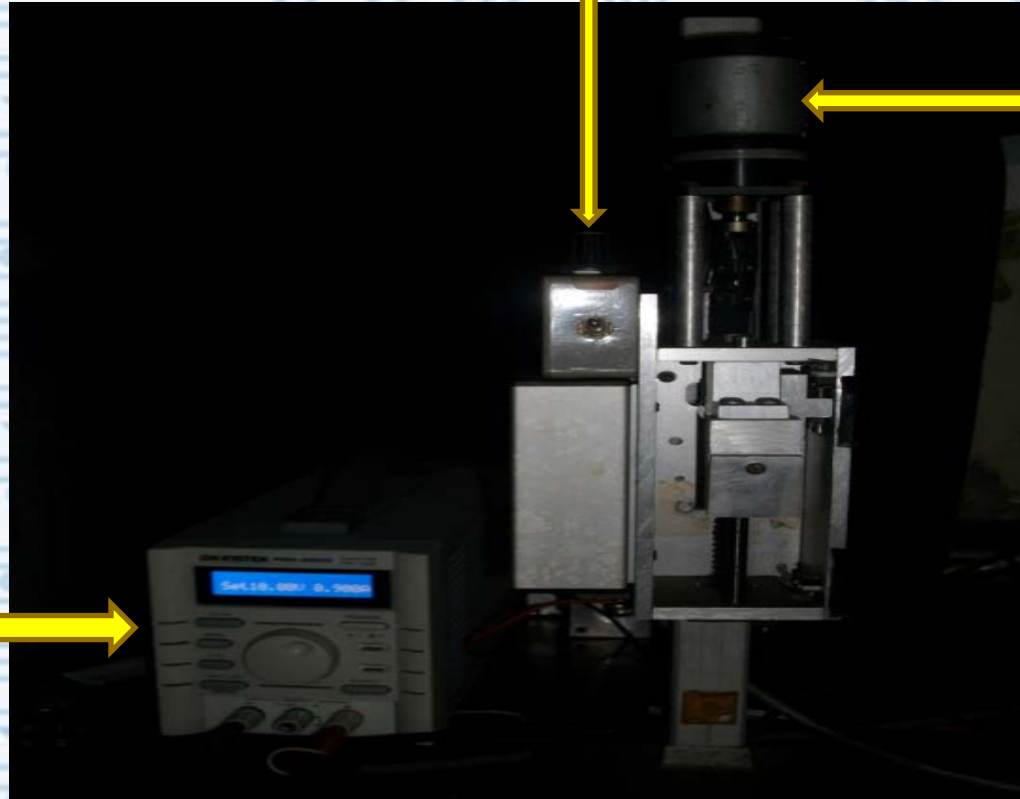
Analyzed



**Accelerator
Controller**

Motor

**Power
Supply**



Deep Coating Machine



In this research, the steps or stages as following:

- Prepare equipment and materials
- Make a solution of PVDF with several concentrations
- Dissolution process by providing appropriate heating
- Preparing deep coating machine
- Placing glass preparations (substrate) on the machine deep
- Placing PVDF solution in the space provided on the machine deep coating..
- Implement deep coating process
- drying the sample
- Annealing process
- PVDF films characterization by FTIR and XRD



RESULT AND DISCUSSION

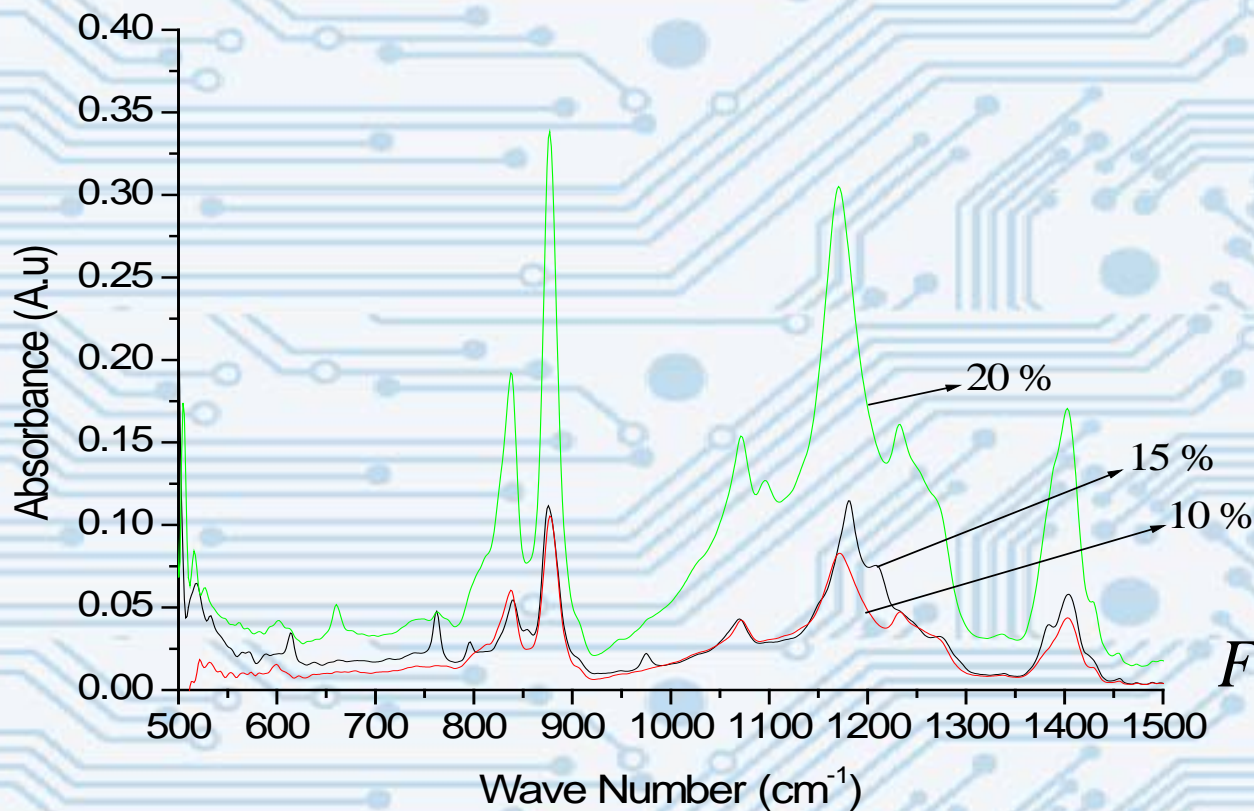
PVDF films have been obtained with three concentrations of solvents, namely 10%, 15% and 20%. as shown follow:



PVDF film sample



CHARACTERIZATION



Betha Fraction
calculation

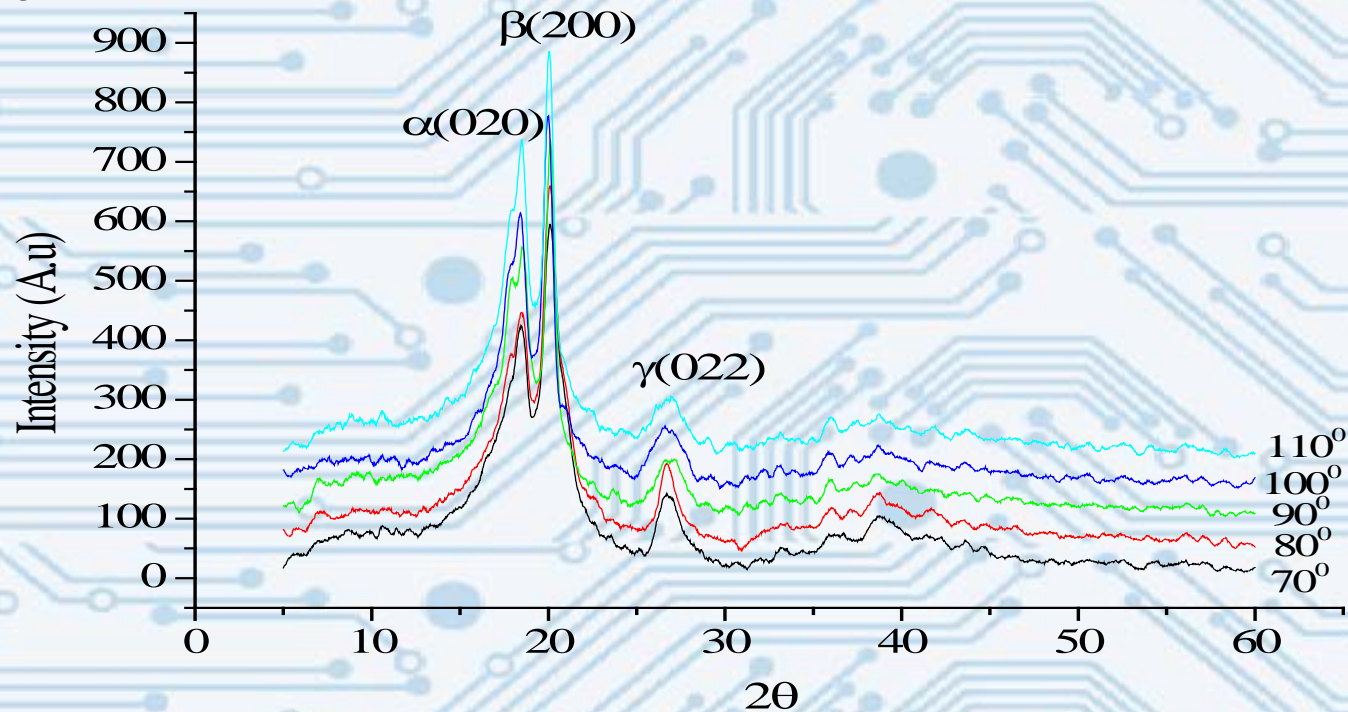


$$F(\beta) = \frac{A_{\alpha}}{A_{\alpha} + A_{\beta}} \times 100\%.$$

Spectrum IR samples for three variations of the concentration of solvent

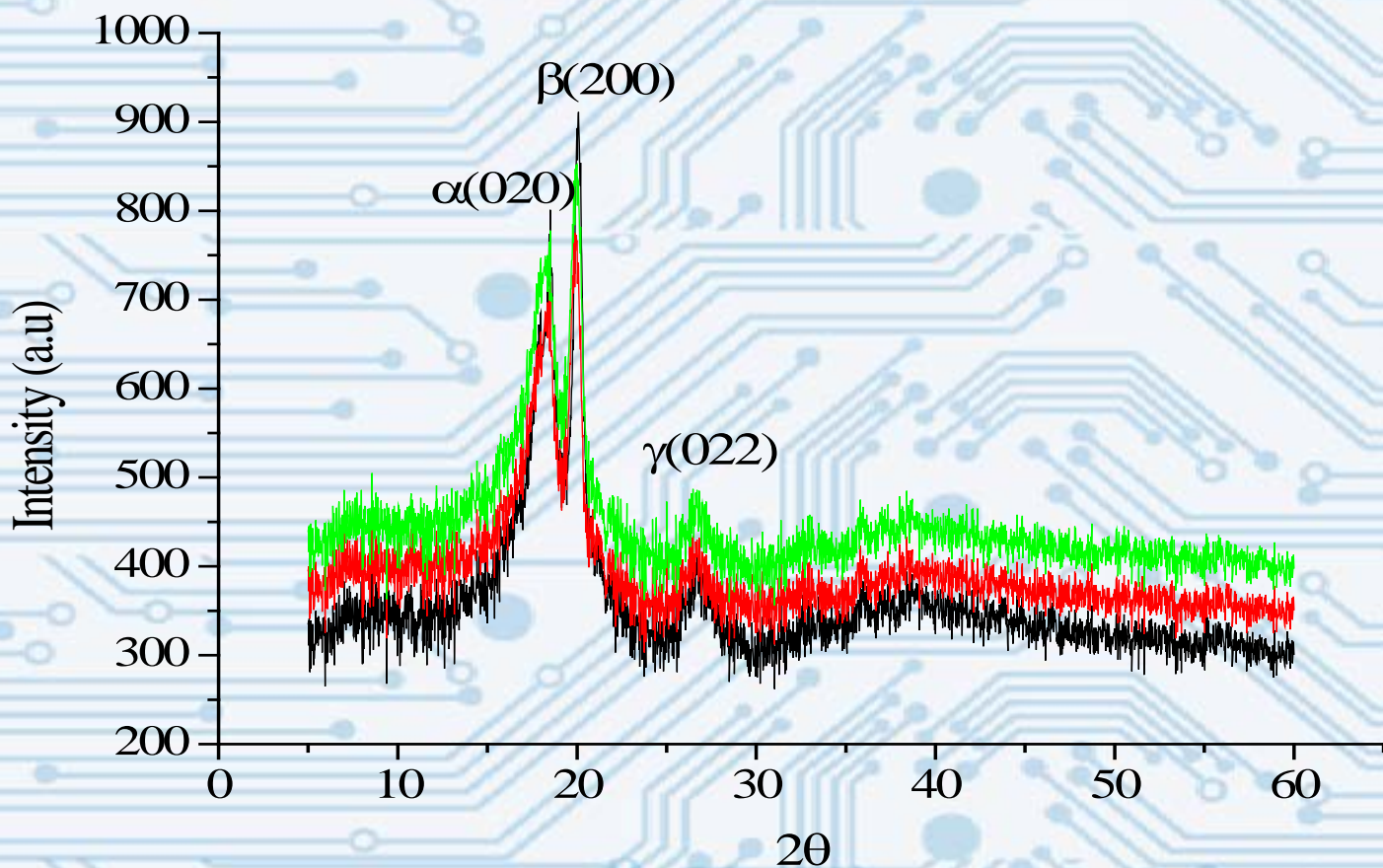
“These results show an increase in the β fraction with increasing concentration”

XRD characterization results of samples with temperature variation



Diffraction pattern of the sample with temperature variations

Diffraction results showed an increase of β fraction with increasing temperature



Diffraction pattern of the sample with time-varying (10, 20, 30) minutes warming to temperatures 110° C



CONCLUSION



Beta fraction The optimum solvent concentration are 20% with beta fraction are **44,5%**



The optimum annealing temperature is **110°C** with beta fraction **58%** and a long warm-up time is 30 minutes with **60%** beta fraction



Obviously the result made PVDF films exhibit good piezoelectric properties.



Research Output



Paper:

1. Ambran hartono, Mitra Djamal, Suparno Satira, Herman, Ramli, "Preparation of PVDF Thin Film Using Deep Coating Method for Biosensor Transducer Applied," Proceeding of 2013 3rd ICICI-BME, *IEEE Catalog Number: CFP1387H-ART ISBN: 978-1-4799-1650-4(2013) pp 408-411.*
2. Mitra Djamal, Suparno Satira, Herman Bahar, Ambran Hartono, Dadang Suhendar, Ramli, Development of HVDC 20kV Amplifier for Optimization of Polymer Actuator, ICSSA 2014



THANK YOU