

Comparison of Triethylarsenic and Trisdimethylaminoarsenic Sources for MOCVD Growth of GaAs

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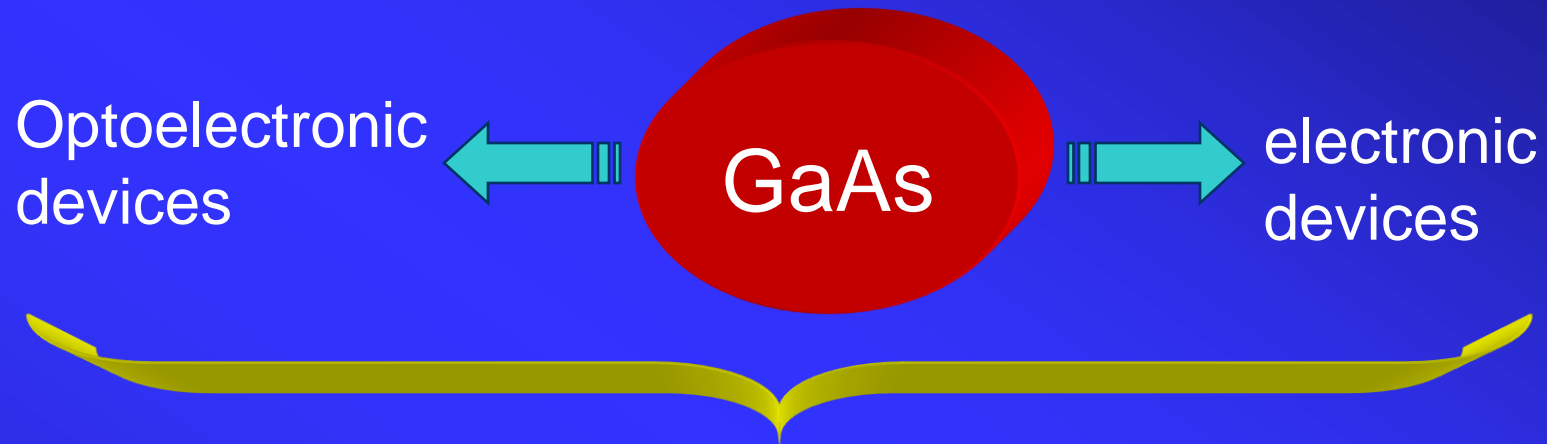


OUTLINE

- INTRODUCTION
- EXPERIMENTAL PROCEDURE
- DISCUSSION
- CONCLUSION



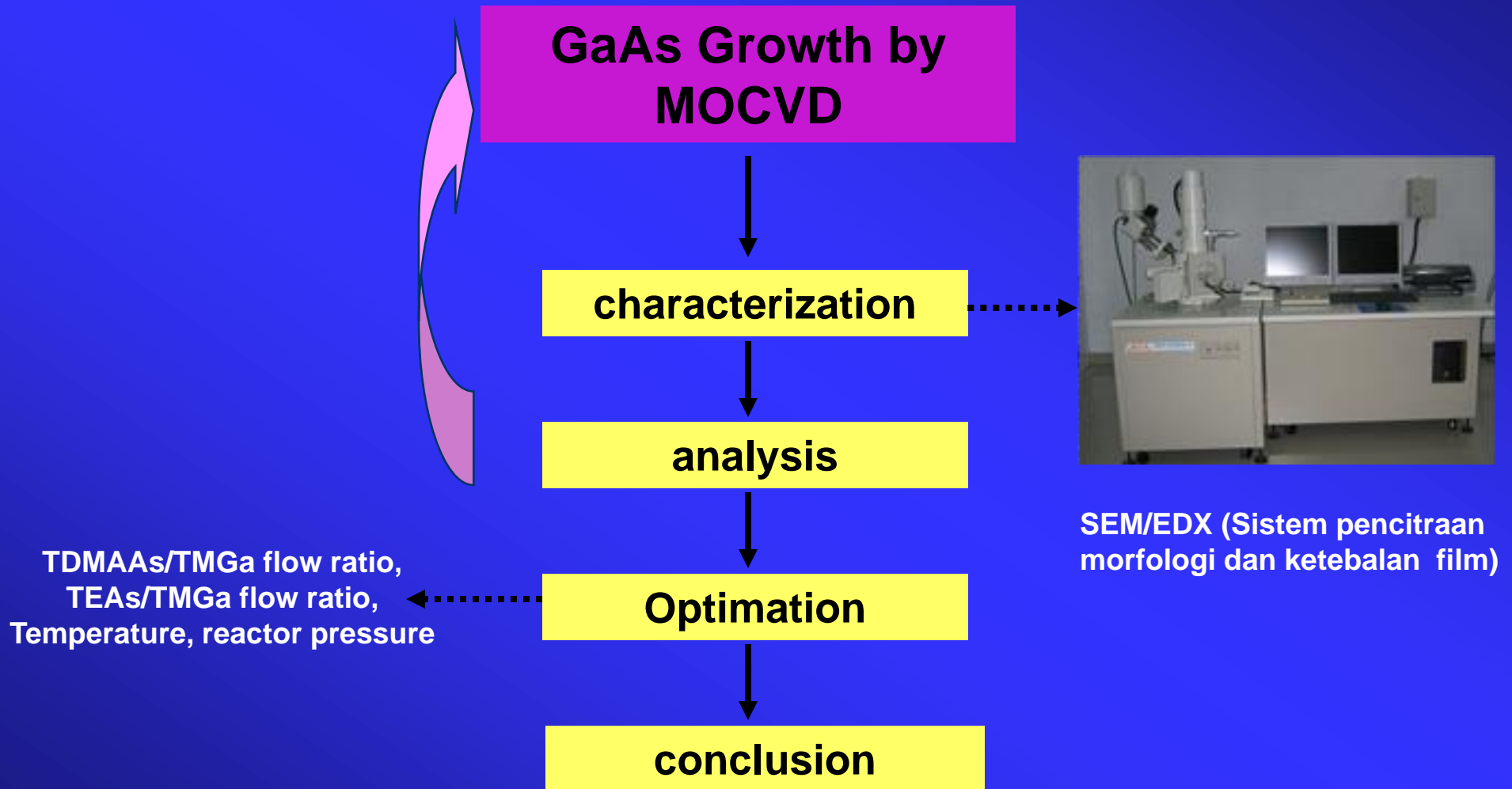
INTRODUCTION (1)



Study about the growth process and metal organic sources:

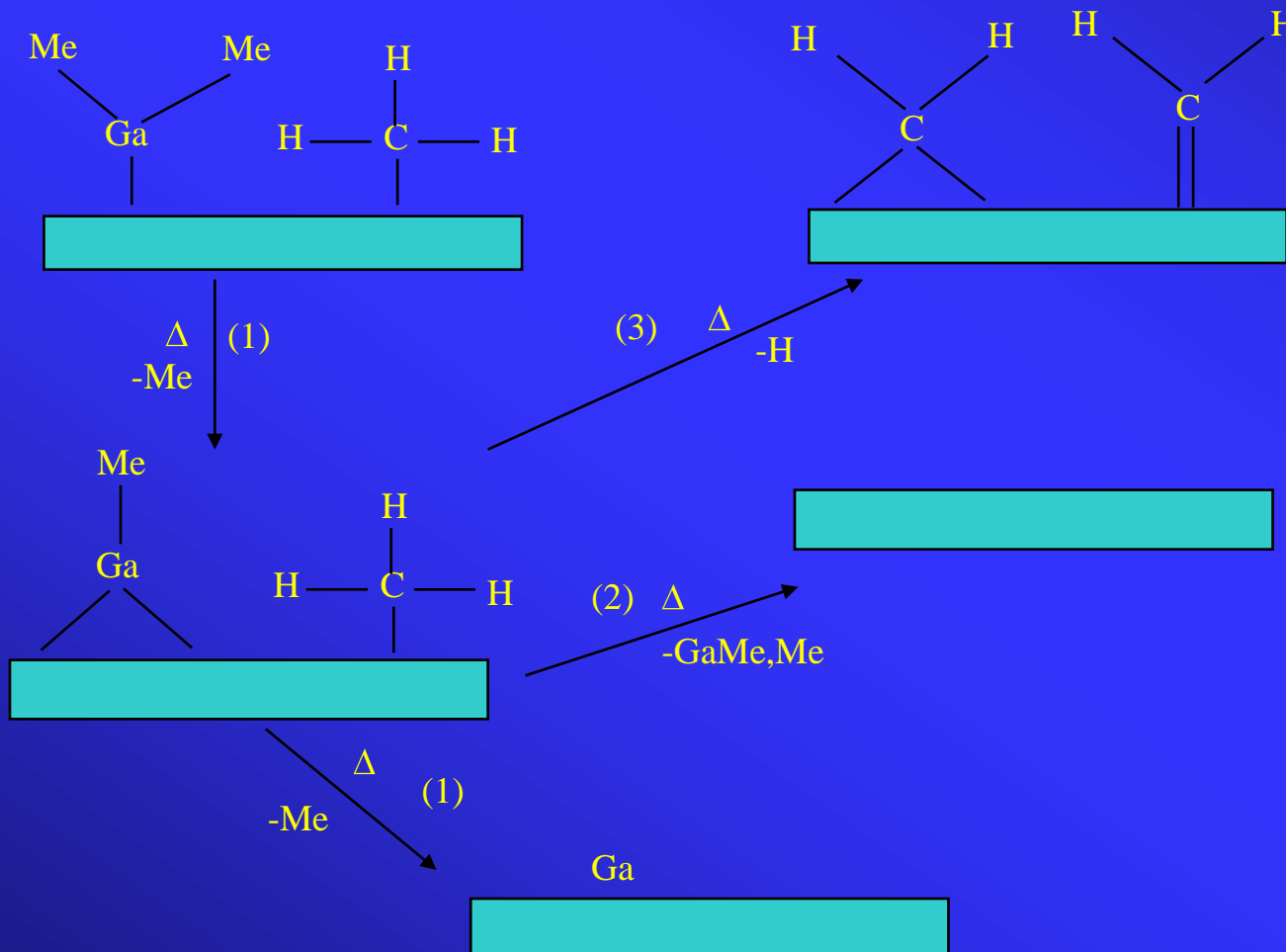
- Growth process: MOCVD, MOMBE, CBE, PLD.
- MO sources: PH_3 , AsH_3 , TMAs, TEAs, TDMAAs

GROWTH PROCEDURE



DISCUSSION (1)

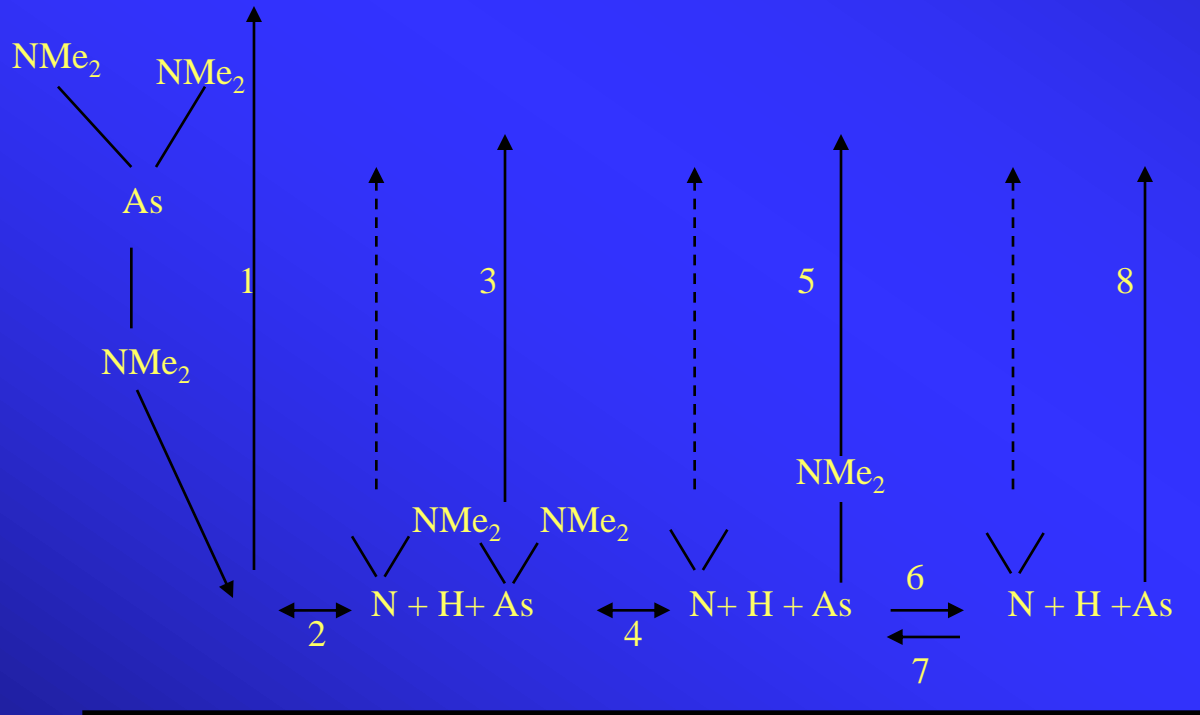
TMGa decomposition process on substrate surface



The dominant decomposition route for TMGa at GaAs surface involves the sequential loss of CH₃ groups from the surface, although some CH₃ groups also desorb as MMGa species (route 3). The formation of CH₂ species at elevated temperature indicates an additional decomposition pathway involving hydrogen abstraction from CH₃ groups bonded to the surface (route 2).

DISCUSSION (2)

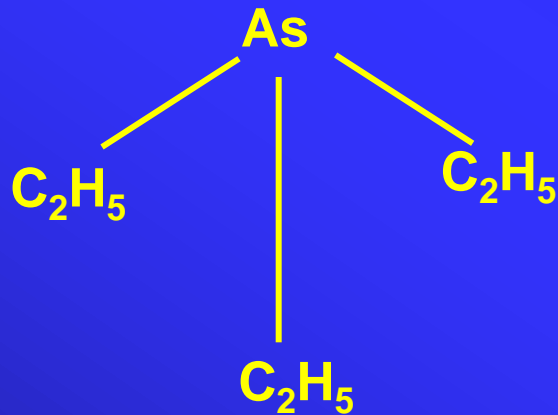
TDMAAs decomposition process on substrate surface



As the substrate temperature is increased above 470°C , a radical change of AsNMe_2^+ and AsNMe^+ is observed increase in MMBS signals and As^+ decrease. With reference to the decomposition scheme of TDMAAs, there appear to be an increase in the desorption of high mass As-containing species (steps 1, 3, 5) at the expense of decomposition to form As atoms (step 6). Steps 2 and 4 probably continue to occur. It is also conceivable that the recombination of As and amine species (step 7) occurs at the expense of desorption of As (step 8).

DISCUSSION (3)

TEAs decomposition process on substrate surface



A detailed decomposition process of TEAs on GaAs substrate still could be understood, but from the TEAs molecular structure depicted in fig.2, it can understood that the arrangement involving As-C bond will resulted from decomposition. This because of the TEAs molecular structure has direct bond between As-C.

DISCUSSION (4)

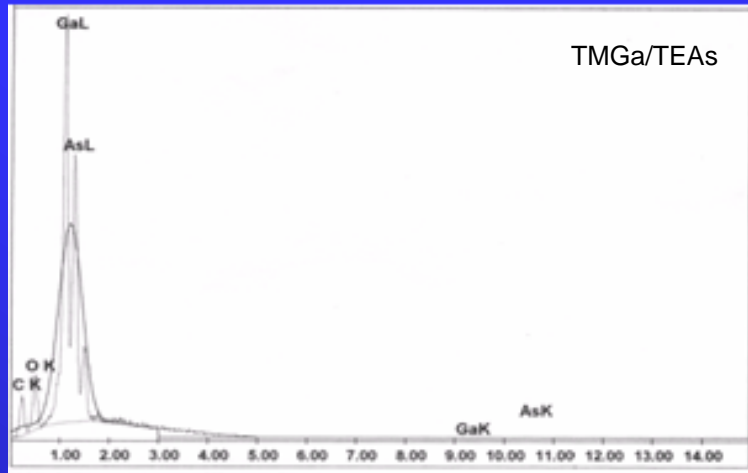
Percentage of atom of GaAs grown by TMGa/TEAs sources

Sample no.	Atomic %	
#2	GaK = 54,49 AsK = 45,51	1,19
#15	GaL = 42,63 AsL = 57,37	1,34
#30	GaL = 52,14 AsL = 47,86	1,09
#40	GaL = 57,51 AsL = 42,49	1,35



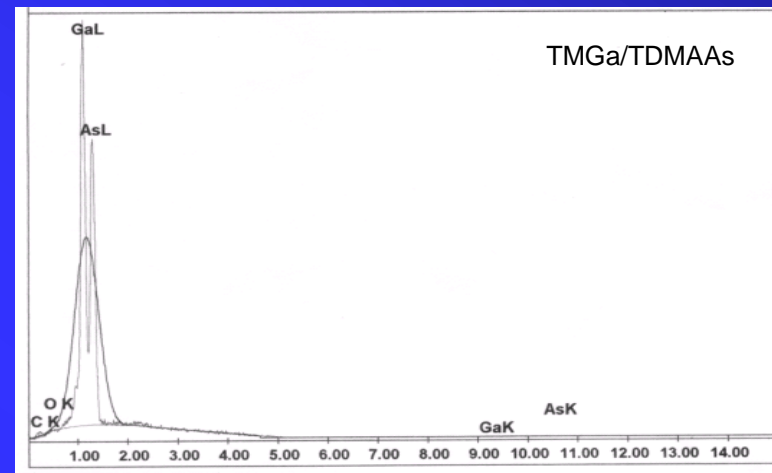
DISCUSSION (5)

Atomic percent of Ga:As grown using TMGa/TEAs and TMGa/TDMAAs sources measured by EDX method.



EDX ZAF Quantification (Standardless)
Element Normalized

Element	Wt%	K-ratio	Z	A	F
C K	16.29	0.0571	1.34674	0.2602	1.0000
O K	0.00	0.0000	1.3211	0.5262	1.0004
GaL	35.11	0.3229	0.9317	0.9847	1.0026
AsL	48.60	0.3770	0.9114	0.8512	1.0000
Total	100.00				

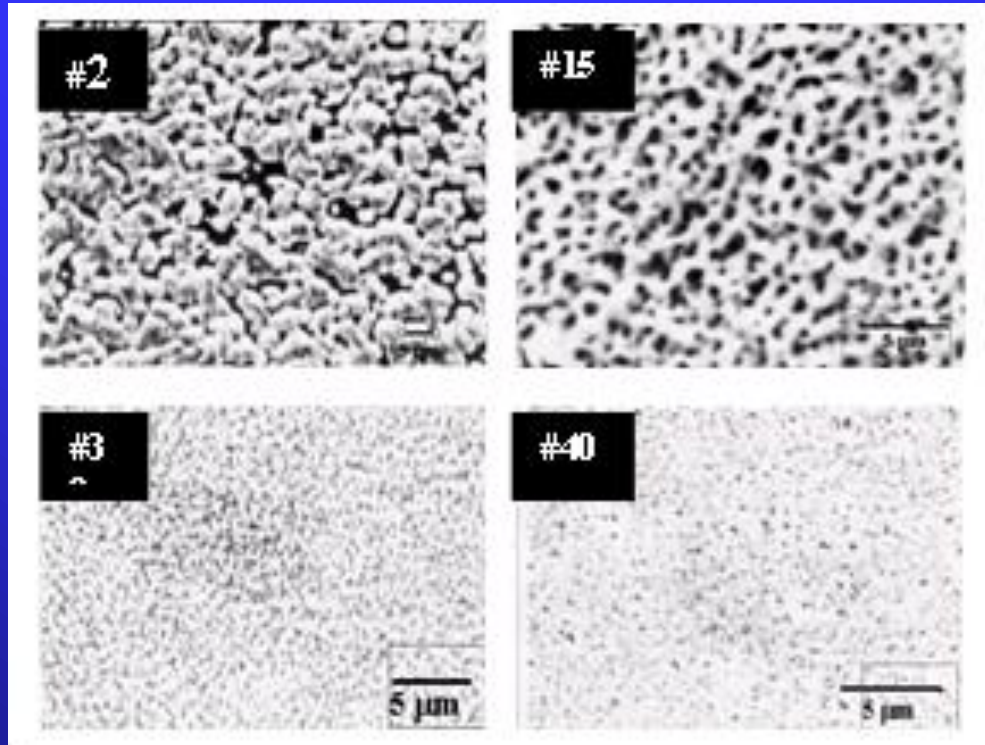


EDX ZAF Quantification (Standardless)
Element Normalized

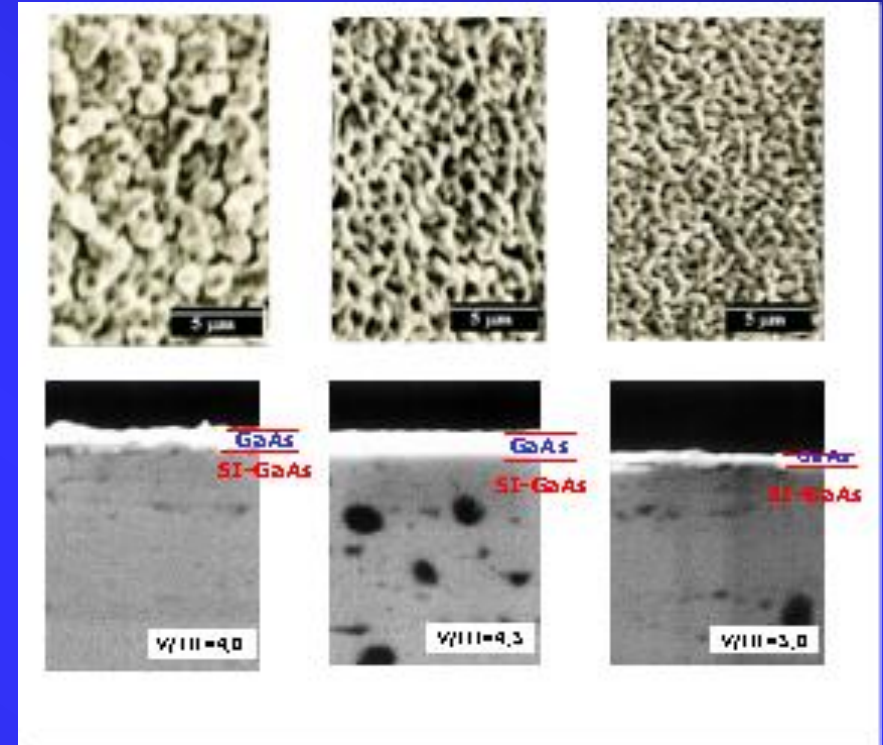
Element	Wt%	K-ratio	Z	A	F
C K	3.03	0.0100	1.4374	0.2292	1.0000
O K	0.00	0.0000	1.4124	0.5483	1.0000
GaL	54.00	0.5303	0.9935	0.9865	1.0020
AsL	42.97	0.3231	0.9717	0.7740	1.0000
Total	100.00				

DISCUSSION (6)

Surface morphology of GaAs thin films grown using TMGa/TEAs and TMGa/TDMAAs sources characterized by SEM method.



(A)
(a) TMGa/TEAs sources



(a) TMGa/TDMAAs sources

CONCLUSSIONS

1. The growth of GaAs thin films with TEAs and TMGa sources revealed that almost all of the grown films have certain high C concentration (around 16%), with its non-uniform surface morphology. The high C concentration in these films is caused by the CH₃ and C₂H₅ species presence in TMGa and TEAs, respectively, which act as a source of impurity.
2. The GaAs films grown using TDMAAs and TMGa sources have better characteristics compared to GaAs films grown using TMGa and TEAs sources. The films have good structural properties with certain low C concentration (around 3 %).



Thank you

